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MONTHLY WEATHER REVIEW

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THE AREAL DISTRIBUTION OF MEAN ANNUAL RAINFALL OVER THE ISLAND OF HISPANIOLA

By LEO ALPERT

[Clark University, Worcester, Mass., July 1940]

The new map of annual rainfall distribution over the island of Hispaniola here presented is based upon data for 162 stations and detailed information made available in recent years. It indicates that the areal distribution of mean annual rainfall over this island is the most irregular of any unit of the Greater Antilles, ranging from less than 20 inches on leeward lowlands and enclosed interior valleys to more than 100 inches on elevated mountain slopes and favorably located areas at low elevation.

INTRODUCTION

The areal distribution of rainfall over the island of Hispaniola has not previously been mapped in detail because of the inadequacy of the rainfall data, and the marked dependence of rainfall on local relief for which accurate topographic maps are not available. The only map of annual rainfall known to the author[1] was published in 1929 by Oliver L. Fassig. Referring to this map, Fassig wrote:

> The accompanying chart is offered as only a first attempt to show the average distribution of rainfall over the entire island.
>
> The distribution over Haiti is based upon the average annual values for 27 stations with records of 10 years or more and covering an average period of 18 years. The distribution over Santo Domingo is based upon records at 50 stations, averaging 7 years.

In Fassig's study, limited data and lack of information about many sections of the island necessitated broad generalizations which failed to bring out the irregularity characteristic of rainfall distribution. The availability of data from more than twice as many stations, and records with longer periods of observation, now justify a new compilation of annual rainfall distribution.

Records for 162 stations,[2] covering an average period of 14 years, form the basis for the accompanying map. For the Republic of Haiti 79 stations, covering an average period of 17 years, were used, of which 24 stations have records of 20 years or more, 36 stations have records of 10 to 19 years, and 19 stations have records of 4 to 9 years. For the Dominican Republic 83 stations, covering an average period of 11 years, were used, of which 2 stations have records of 30 and 31 years, respectively, 56 stations have records of 10 to 15 years, and 25 stations have records of 4 to 9 years.

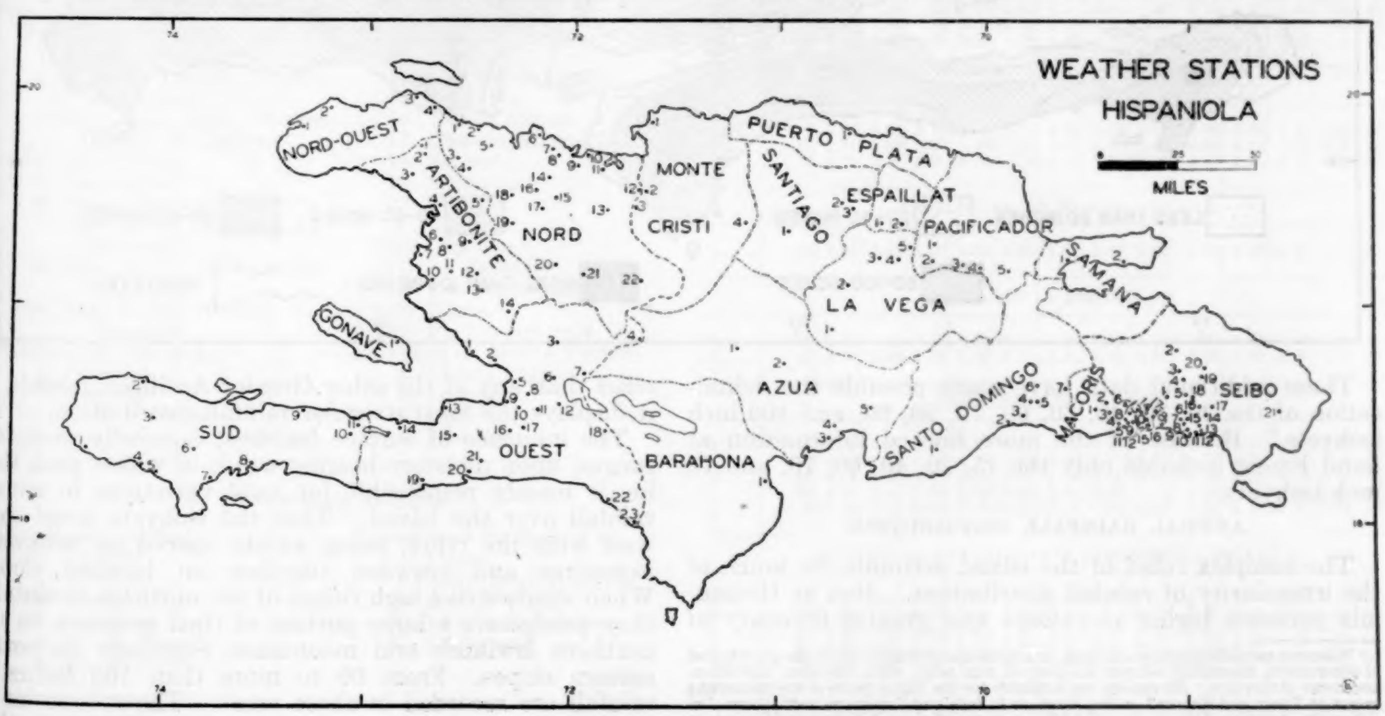
[1] Fassig, Oliver L., A Tentative Chart of Annual Rainfall over the Island of Haiti-Santo Domingo, MONTHLY WEATHER REVIEW, July 1929, Vol. 57, p. 296.

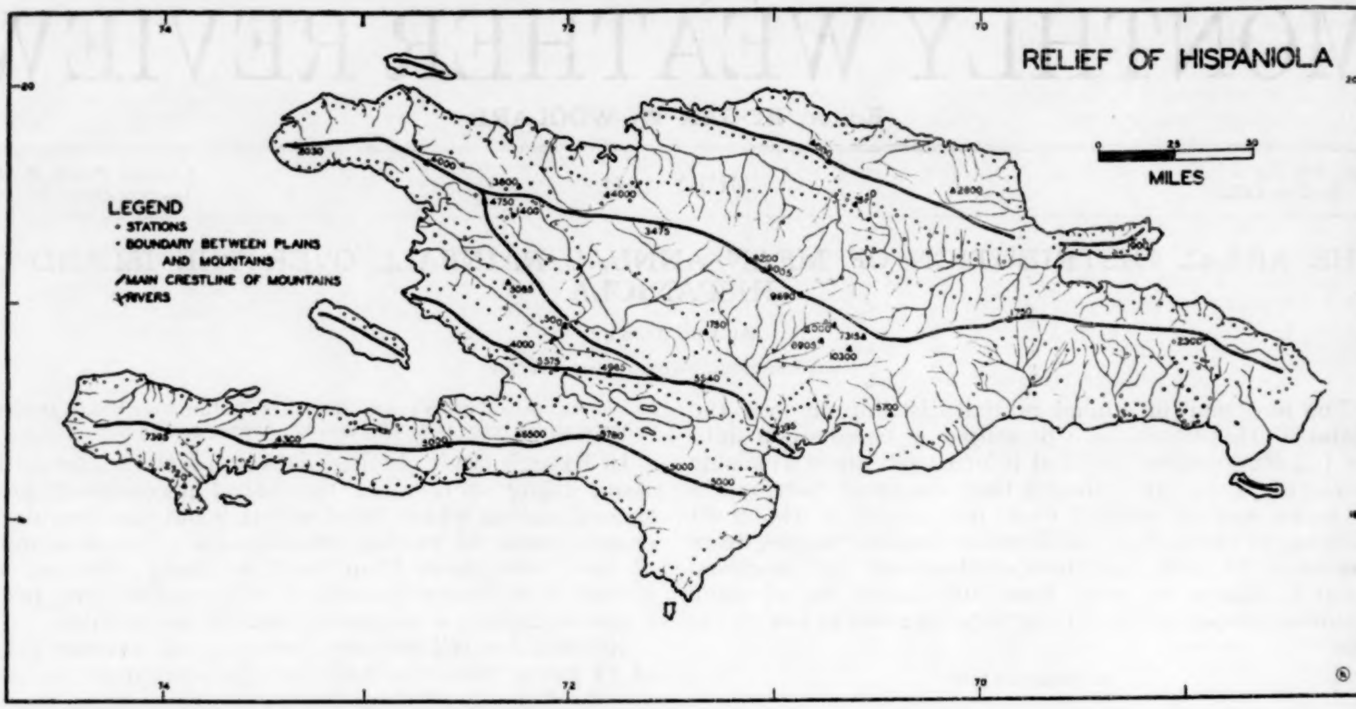
[2] U. S. Weather Bureau, *Climatological Data, West Indies and Caribbean Service*, San Juan, Puerto Rico.

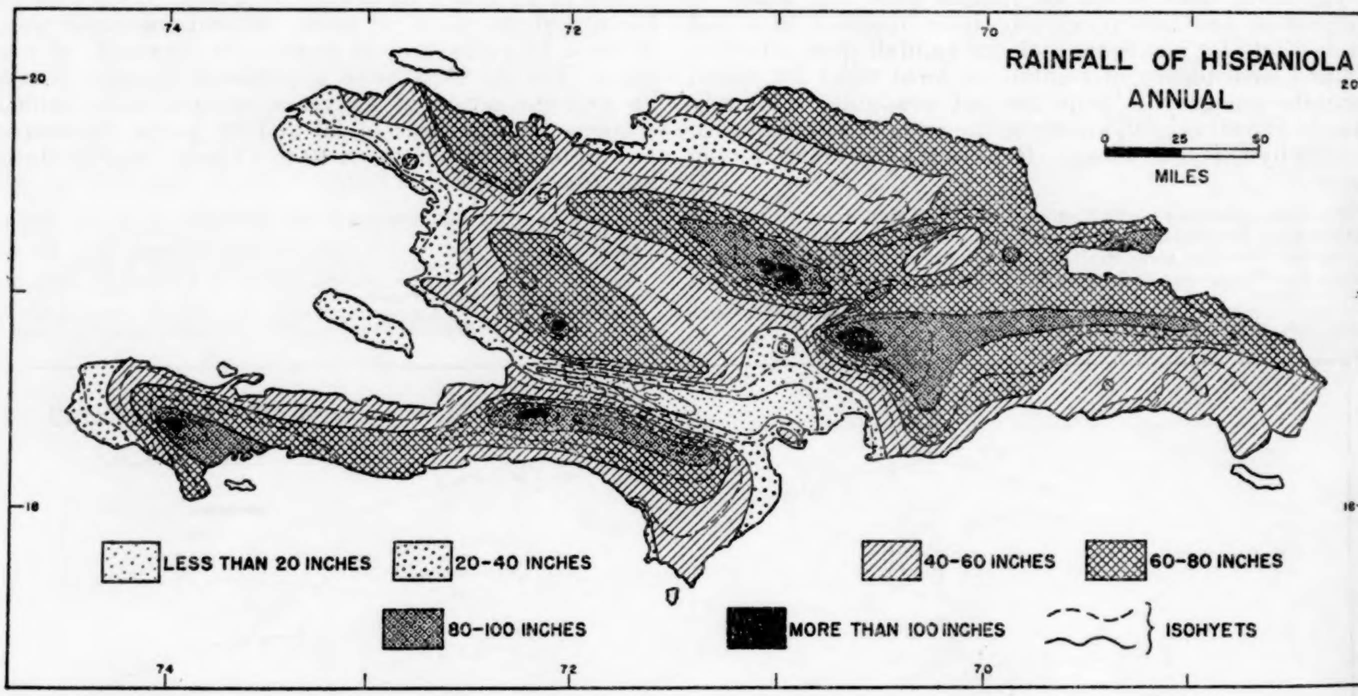
Direction Generale Des Travaux Publics, "Les Eaux De Surface De La Republique D'Haiti," *Bulletin Hydrographique*, Port-au-Prince, Republique D'Haiti.

Seminaire College St. Martial, *Bulletin Annual De L'Observatoire Meteorologique*, Port-au-Prince, Republique D'Haiti.

Secretaria De Estado De Agricultura Y Trabajo, Seccion De Meteorologia, *Estadisticas De Las Lluvias En La Republica Dominicana*, Ciudad Trujillo, Republica Dominicana.







These additional data have made possible the delimitation of the 20, 30, 40, 50, 60, 70, 80, 90, and 100 inch isohyets.[3] Because of the more limited information at hand Fassig included only the 15, 20, 40, 60, 70, and 75 inch isohyets.

ANNUAL RAINFALL DISTRIBUTION

The complex relief of the island accounts for much of the irregularity of rainfall distribution. Just as Hispaniola presents higher elevations and greater diversity of relief than any of the other Greater Antillean Islands, so it displays the most irregular rainfall distribution.

The influence of surface features, especially mountain ranges, upon moisture-bearing winds in whose path they lie, is mainly responsible for local variations in annual rainfall over the island. Thus the isohyets trend east-west with the relief, being widely spaced on windward exposures and crowded together on leeward slopes. When winds strike high ridges of the northern mountains they precipitate a large portion of their moisture on the northern lowlands and mountains, especially on northeastern slopes. From 60 to more than 100 inches of rainfall are recorded in these areas. The mountains of the interior and the south are high enough to cause further

[3] Wherever rainfall stations are lacking, or records are unreliable due to the short period of observation, theoretical isohyets are derived from relief, wind direction, vegetation, and notes of travelers. No records are available for the higher parts of the mountains except at Furcy and Kenscoff on the Sierra de la Selle and Constanza on the Sierra Del Cibao; the elevation of Furcy is about 5,600 feet, Kenscoff about 5,000 feet, and Constanza about 4,000 feet.

rainfall on their upper slopes; but leeward slopes and lowlands, especially in the west and southwest, are less abundantly watered. The latter regions become increasingly drier as elevation decreases, several leeward lowland areas receiving less than 20 inches annually.

Wide extremes of rainfall are encountered over the island. Mirebalais (21-year record) receives 122 inches of rainfall, whereas Thomazeau (31-year record), less than 15 miles distant, receives only 32 inches. Gonaives (46-year record) receives only 22 inches, the least of any station with a long record, though Central Ocoa (6-year record) receives 16 inches and Anse-a-Pitre (4-year record) less than 12 inches.

WEATHER STATIONS OF HISPANIOLA

REPUBLICA DOMINICANA

Provincia de Barahona:
1. Barahona.

Provincia de Azúa:
1. San Juan.
2. Central Ocoa.
3. Central Azuano.
4. Azúa.
5. San José de Ocoa.

Provincia de Santiago:
1. San José de las Matas.
2. Santiago.
3. Puntezuela.

Provincia de Puerto Plata:
1. Puerto Plata.

Provincia Espaillat:
1. Moca.
2. Salcedo.

Provincia de la Vega:
1. Constanza.
2. Jarabacoa.
3. La Vega.
4. Las Cabullas.
5. La Jagua.

Provincia Pacificador (Provincia Duarte):
1. Macorís, San Francisco de.
2. La Gina.
3. Pimentel.
4. La Ceiba.
5. Villas Rivas.

Provincia de Santo Domingo (Provincia Trujillo):
1. Central Italia.
2. Ciudad Trujillo (Santo Domingo).
3. San Luis Col. "Santa Rita," El Cojobal.
4. San Luis.
5. San Isidro.
6. Mata Mamon.
7. San Isidro (Colonia C. Brujuela).

(8) San Isidro (Colonia C. Redonda).[1]

(9) San Isidro (Colonia C. Tumba).[1]

Provincia de Samaná:
1. Sánchez.
2. Samaná.

Provincia de Macoris:
1. San Isidro (Colonia C. Cayacoa).

Provincia de Macoris—Con.

2. Quisqueya.
3. Olivari.
4. Central C. Colón.
5. Macorís, San Pedro de.
6. Central Consuelo.
7. Escarraman.
8. Esperanza.
9. Central Porvenir.
10. Porvenir.
11. Gran Peñón.
12. El Soco.
13. Pico Blanco.
14. Kelly.
15. Cumayaza.
16. Jagual.
17. Regajo.
18. Los Arados.

Provincia del Seibo:
1. Campiña.
2. Pedro Sánchez.
3. Salado.
4. Guanábanas.
5. Guaymate.
6. Espinillos.
7. La Noria.
8. Higueral.
9. Campo Alegre.
10. La Romana.
11. Loading Sta. No. 29 (C. Primo).
12. Rancho Viejo.
13. La Luisa.
14. Los Mosquitos.
15. Guerrero.
16. Nuevo Aleton.
17. Chavón Abajo.
18. Sabaná.
19. Bermejo.
20. Pintado.
21. La Gina.

(22) Cajuilles.[1]

(23) La Cacata.[1]

(24) Las Mercedes.[1]

(25) Nigua.[1]

(26) Pueblo Nuevo.[1]

Provincia de Monte Christi:
1. Monte Christi.
2. Dajabón.
3. Capotillo.
4. Mondión.

REPUBLIQUE D'HAITI

Department du Sud:
1. Tiburón.
2. Jérémie.
3. Moron.
4. Chardonniers.
5. Port-à-Piment.
6. Camp-Perrin.

Department du Sud—Con.

7. Cayes.
8. Saint-Louis du Sud.
9. Anse-à-Veau.
10. Fonds-des-Nègres.
11. Miragoane.

[1] Location unknown.

NOTE.—The political divisions and numbers used here refer to the political divisions and numbers shown on the map of Weather Stations of Hispaniola. Thus, number 1 in Provincia de Azúa is San Juan, number 2 is Central Ocoa, etc.

Department de L'Ouest:
1. Arcahaie.
2. Cabaret.
3. Mirebalais.
4. Belladère.
5. Hatte Lathan.
6. Thomazeau.
7. Grand-Bois.
8. Croix-des-Bouquets.
9. Port-au-Prince.
10. Pétion-Ville.
11. Bassin Général Riv. Grise.
12. Ganthier.
13. Léogâne.
14. Petit-Goâve.
15. Trouin.
16. Furcy.
17. Kenscoff.
18. Fonds-Verrettes.
19. Bainet.
20. Jacmel.
21. Gaillard.
22. Bodaire (Gr. Gosier).
23. Anse-a-Pitre.

Ile de la Gonaive:
1. Anse-à-Galets.

Department de L'Artibonite:
1. Bassin-Bleu.
2. Gros-Morne.
3. Terre-Nueve.
4. Gonaïves.
5. Ennery.
6. Desdunes.
7. Grande-Saline.
8. Bocozell.

Department de L'Artibonite—Continued.

9. Dessalines.
10. Saint-Marc.
11. Pont-Sondé.
12. Petite-Rivière.
13. Verrettes.
14. La Chapelle.

Department du Nord-Ouest:
1. Môle St.-Nicolas.
2. Jean-Rabel.
3. Port-de-Paix.
4. Saint-Louis du Nord.

Department du Nord:
1. Borgne.
2. Bayeux.
3. Pilate.
4. Plaisance.
5. Limbé.
6. Cap-Haitien.
7. Bonnay.
8. Limonade.
9. Trou.
10. Botany.
11. Bonnement.
12. Ouanaminthe.
13. Vallières.
14. Grande Rivière.
15. Bahon.
16. Dondon.
17. Saint-Raphaël.
18. Marmelade.
19. Saint-Michel.
20. Maïssade.
21. Hinche.
22. Cerce-la-Source.

REPUBLICA DOMINICANA

Station	Years of record	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Annual
PROVINCIA DE BARAHONA														
1	14	0.70	0.52	0.71	2.08	6.17	4.53	1.47	2.70	4.74	6.43	2.44	0.84	33.33
PROVINCIA DE AZUA														
1	5	0.74	0.67	1.31	3.53	3.93	3.32	5.17	6.22	6.83	6.78	3.19	0.79	42.38
2	6	.81	.12	.26	.73	2.79	1.44	1.44	1.42	1.80	2.14	2.69	.33	15.52
3	10	.47	.36	.57	1.83	2.93	1.47	2.45	1.35	4.23	4.57	3.65	.43	24.73
4	10	1.62	.39	.83	1.77	3.33	2.29	3.73	2.52	4.71	4.46	3.22	.58	29.45
5	6	5.28	1.75	.95	2.22	7.74	3.96	2.65	5.08	5.97	6.00	3.96	1.18	46.74
PROVINCIA DE SANTIAGO														
1	9	2.60	2.63	3.85	5.13	8.75	4.59	1.78	2.17	4.96	4.56	7.14	3.49	51.65
2	11	2.11	1.10	2.67	3.96	7.28	3.25	2.31	3.40	5.06	4.75	6.74	3.17	45.80
3	7	3.16	.89	3.01	4.68	7.73	2.10	2.21	2.06	4.43	4.90	7.41	5.06	48.55
PROVINCIA DE PUERTO PLATA														
1	31	7.31	5.82	4.12	5.34	4.33	1.75	2.88	2.98	4.35	4.35	14.03	9.88	67.14
PROVINCIA ESPAILLAT														
1	15	4.34	1.41	2.78	3.72	4.44	2.86	2.55	3.14	4.39	4.02	6.10	5.04	44.79
2	15	3.89	1.83	3.32	3.55	5.15	3.41	4.40	3.54	4.56	4.48	6.85	4.96	49.94
PROVINCIA DE LA VEGA														
1	7	2.51	1.20	1.26	3.96	9.15	4.75	3.25	5.00	6.49	6.13	4.95	4.08	52.73
2	6	4.98	1.23	2.87	4.49	8.45	2.99	2.71	5.07	4.72	5.29	6.57	6.58	55.95
3	15	5.93	2.60	4.99	5.52	7.61	4.45	5.19	5.27	6.65	6.80	9.79	6.91	71.71
4	15	5.00	2.45	4.36	6.20	6.22	4.84	5.93	5.67	6.06	6.25	8.36	6.51	67.85
5	9	11.46	2.45	5.95	7.19	10.91	6.49	7.70	6.47	7.19	4.43	10.01	5.68	89.23
PROVINCIA PACIFICADOR (PROVINCIA DUARTE)														
1	12	5.47	2.46	4.30	7.54	8.67	5.28	8.31	8.31	8.76	7.11	13.65	8.35	88.21
2	14	4.37	1.57	3.45	3.55	5.59	2.30	3.71	3.78	3.61	3.51	6.84	5.26	47.54
3	15	4.01	2.83	2.62	2.88	6.52	3.65	5.30	4.48	4.24	4.05	6.42	5.32	52.32
4	15	5.40	2.30	2.72	3.76	8.94	5.34	6.02	5.58	4.92	4.58	7.98	5.85	63.39
5	15	7.10	1.45	3.32	4.68	7.94	9.95	8.36	7.63	10.00	6.99	11.41	8.64	87.01

NOTE.—The stations are numbered according to political divisions the same as they appear on the sheets titled Weather Stations of Hispaniola. Thus, Provincia de Barahona station 1 is Barahona: Provincia de Azua station 1 is San Juan, station 2 is Central Ocoa, etc.

REPUBLICA DOMINICANA—Continued

PROVINCIA DE SANTO DOMINGO (PROVINCIA TRUJILLO)

Station	Years of record	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Annual
1	14	2.32	2.16	2.50	4.42	9.96	9.70	7.03	8.04	10.57	7.39	5.51	1.92	71.52
2	30	2.24	1.20	2.18	3.65	6.42	6.06	6.39	6.25	7.24	6.13	4.93	2.16	54.85
3	4	.99	2.18	.94	3.66	2.89	7.92	9.71	6.60	8.88	6.26	6.90	2.91	59.82
4	12	2.73	2.03	1.56	4.07	7.28	7.76	8.91	8.17	9.38	6.67	6.52	2.75	67.11
5	15	2.52	2.02	1.93	3.45	6.68	6.31	8.10	7.66	8.37	6.81	5.83	2.53	62.21
6	6	1.85	1.26	.95	3.20	8.23	7.52	10.42	10.24	8.81	8.42	7.97	3.05	71.92
7	10	1.83	1.23	1.53	3.67	6.18	4.44	6.56	6.14	7.46	6.07	5.24	2.09	52.36
(8)	9	2.09	.94	1.34	3.49	6.35	4.53	6.13	5.99	8.54	7.21	5.85	2.30	55.27
(9)	10	2.35	1.28	1.21	3.85	6.10	3.94	4.76	5.28	7.19	6.54	5.77	2.48	50.80

PROVINCIA DE SAMANA

Station	Years of record	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Annual
1	15	5.85	2.57	4.48	5.49	7.55	5.94	7.74	7.36	6.73	5.53	10.31	7.10	76.38
2	6	7.24	5.65	5.88	8.30	11.49	12.72	10.56	10.00	12.72	10.72	12.72	14.38	122.38

PROVINCIA DE MACORIS

Station	Years of record	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Annual
1	9	1.99	1.03	1.57	3.57	6.00	4.55	5.67	6.50	8.74	9.10	6.08	2.37	55.32
2	9	1.96	1.93	1.60	3.94	8.04	5.47	7.24	9.11	9.06	8.41	6.21	2.36	65.60
3	11	1.95	1.25	1.41	3.67	6.79	4.89	4.87	6.95	8.00	5.90	5.13	1.58	52.39
4	15	1.78	1.21	.81	3.06	5.91	3.99	4.38	5.21	7.50	5.73	4.70	1.77	46.05
5	15	1.82	1.36	1.36	2.71	4.59	3.80	3.45	4.29	7.99	5.30	4.41	1.59	42.67
6	15	1.88	1.38	1.84	4.17	6.25	5.85	5.94	7.33	8.50	7.34	5.12	1.69	57.30
7	5	1.71	1.39	1.57	3.35	5.76	3.10	5.32	6.57	8.12	5.85	6.82	1.92	61.20
8	8	1.53	1.60	1.22	3.28	9.41	4.94	3.75	5.78	9.24	4.63	4.40	1.61	51.39
9	15	1.60	1.50	1.18	2.80	6.05	4.06	4.26	5.11	7.55	5.40	4.80	1.52	45.83
10	10	1.77	1.22	1.11	3.12	7.16	4.27	4.58	6.17	7.06	6.88	4.60	1.61	49.55
11	11	1.67	1.63	1.25	2.73	6.27	3.96	3.91	5.62	8.55	5.61	5.78	2.27	49.25
12	11	2.06	1.54	1.31	3.34	6.58	4.69	5.61	6.96	7.74	5.97	5.32	2.04	53.16
13	11	1.71	1.59	1.59	3.26	6.50	4.83	5.22	7.57	7.69	5.42	6.62	2.06	54.06
14	11	1.62	1.57	1.40	3.04	6.79	5.37	5.64	7.30	7.96	5.94	6.81	2.27	55.70
15	11	1.89	1.17	1.32	2.59	6.91	3.95	4.12	5.74	7.53	4.63	5.04	1.24	46.13
16	11	2.00	1.83	1.47	3.30	6.20	4.90	4.84	7.46	8.28	6.50	6.74	2.05	55.57
17	7	2.18	2.07	1.67	5.09	7.05	4.73	3.95	6.05	9.38	5.14	4.26	1.61	53.18
18	11	1.74	1.55	1.26	2.64	6.14	4.37	4.75	5.99	8.17	5.59	5.04	1.52	48.76

PROVINCIA DEL SEIBO

Station	Years of record	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Annual
1	14	1.91	1.46	1.43	3.90	5.13	3.50	3.26	6.56	7.05	5.73	5.79	1.83	47.55
2	6	4.38	2.32	3.36	5.10	12.95	6.96	4.37	6.43	10.93	8.13	9.84	4.19	78.96
3	11	2.23	1.47	1.70	4.07	9.05	5.02	6.12	6.32	8.13	6.69	4.97	2.58	58.30
4	14	2.51	1.46	1.35	3.73	6.63	4.81	5.94	5.67	7.55	6.29	4.93	2.38	53.25
5	14	2.21	1.68	1.50	3.35	6.40	4.61	4.09	5.42	7.41	5.54	5.19	2.38	49.78
6	12	1.72	1.73	1.62	3.85	6.24	3.62	3.94	5.57	7.77	5.29	5.13	2.25	48.75
7	12	1.98	1.17	1.17	3.18	4.96	4.00	4.44	5.81	7.88	4.97	5.52	1.80	46.88
8	14	1.93	1.69	1.78	3.66	5.82	3.40	3.68	5.72	6.07	5.52	5.34	1.98	46.59
9	14	1.89	1.86	1.50	3.03	5.44	3.35	3.43	5.34	6.10	5.23	5.03	1.84	44.04
10	15	1.53	1.56	1.25	2.67	4.95	3.02	3.25	4.90	7.10	5.22	4.03	1.51	40.99
11	12	1.73	1.38	1.15	3.02	6.69	4.57	4.03	5.36	7.45	5.45	4.37	1.93	47.13
12	14	2.07	1.64	1.73	2.44	4.75	3.87	2.88	5.09	7.10	5.16	4.28	2.32	43.33
13	12	2.00	1.76	1.62	2.74	5.51	3.63	3.33	5.29	8.02	4.97	4.69	2.00	45.66
14	11	2.16	1.59	1.91	3.21	6.64	4.35	5.05	5.69	7.04	5.30	5.62	2.26	50.82
15	14	1.77	1.40	1.30	3.28	5.50	3.82	3.64	5.30	8.07	5.56	5.52	1.92	47.08
16	10	1.97	1.77	1.62	3.25	7.22	4.25	4.07	6.40	8.78	5.83	4.93	2.44	52.54
17	14	1.87	1.92	1.52	2.47	4.76	3.13	3.17	5.03	7.32	5.15	4.62	1.93	42.89
18	14	2.17	1.76	1.30	3.84	6.22	4.07	4.31	5.66	7.81	5.97	5.05	2.05	50.16
19	14	1.82	1.34	1.05	2.88	4.76	4.00	3.62	4.33	6.62	5.15	4.68	1.74	42.09
20	10	2.67	1.90	1.77	4.45	7.36	5.32	5.67	6.14	7.64	6.66	5.62	2.66	57.86
21	9	2.34	1.32	1.62	4.32	8.66	5.15	5.02	5.82	8.57	6.39	5.05	2.53	56.79
(22)	14	1.81	1.56	1.20	2.38	4.59	2.84	3.11	4.74	7.16	5.42	4.56	1.96	41.33
(23)	12	1.98	2.14	1.93	2.48	5.52	8.96	3.93	5.57	8.04	5.36	5.02	2.49	48.42
(24)	8	2.40	1.74	1.98	3.82	9.31	5.64	4.12	6.02	9.48	6.10	4.48	3.09	58.18
(25)	11	2.34	1.61	2.29	3.79	7.89	4.97	4.51	5.64	8.43	5.81	5.58	2.68	55.54
(26)	14	1.96	1.81	1.16	4.59	6.39	4.27	4.14	5.11	7.09	6.15	5.21	2.11	49.59

PROVINCIA DE MONTE CHRISTI

Station	Years of record	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Annual
1	7	1.18	1.66	2.25	3.89	6.63	5.62	2.14	3.61	4.31	5.36	8.01	1.84	46.50
2	8	.73	1.84	1.93	4.28	9.05	7.12	4.05	5.52	4.72	5.45	6.03	1.83	52.06
3	4	.73	2.64	2.25	3.06	12.95	11.33	5.15	8.69	8.64	8.66	11.20	3.00	78.30
4	6	1.38	2.12	2.54	6.12	10.70	7.42	2.97	4.19	4.65	6.13	6.21	3.61	58.04

REPUBLIQUE D'HAITI

DEPARTMENT DU SUD

Station	Years of record	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Annual
1	7	1.49	1.20	3.14	4.63	2.93	0.37	1.61	2.66	4.12	4.89	3.64	1.02	25.02
2	30	2.89	3.21	3.27	3.79	5.90	4.51	3.69	3.82	3.81	4.76	7.02	3.37	50.12
3	7	3.26	2.28	3.24	8.50	11.91	6.99	5.53	7.09	8.89	10.40	9.73	5.76	71.81
4	9	.76	2.61	2.97	4.70	3.00	1.91	1.93	3.72	5.36	6.82	3.52	1.09	38.39
5	12	1.85	2.34	2.74	3.59	3.37	4.34	4.15	5.27	6.50	13.22	5.45	1.39	54.21
6	13	2.20	3.90	4.50	8.31	9.78	8.17	6.65	8.83	11.05	18.07	9.84	2.46	93.74
7	21	2.80	3.34	4.47	7.26	11.60	7.05	5.02	8.43	9.41	14.02	7.05	2.63	83.06
8	15	1.91	3.30	1.96	7.68	12.04	9.11	7.17	9.68	10.01	13.65	7.43	1.88	85.76
9	27	1.59	1.76	1.97	3.93	6.90	5.30	4.81	5.62	4.66	4.52	4.09	.78	45.91
10	4	.92	.78	4.90	3.49	5.41	3.31	3.69	13.94	5.36	6.44	2.15	.99	51.38
11	12	1.19	1.50	2.02	3.57	7.21	4.53	5.74	5.63	7.35	5.92	2.82	1.58	44.48

REPUBLIQUE D'HAITI—Continued

DEPARTMENT DE L'OUEST

Station	Years of record	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Annual
1	22	0.79	1.21	1.78	2.84	5.52	3.27	2.91	3.43	4.06	3.89	2.74	0.73	32.32
2	8	.58	1.31	3.06	4.72	6.73	4.99	3.70	4.97	5.61	6.02	3.47	.73	37.98
3	21	1.26	2.30	4.26	20.05	15.69	13.76	12.91	16.05	15.52	12.45	5.97	2.20	122.45
4	14	.63	1.85	2.11	7.75	9.56	7.89	5.17	7.04	7.81	8.31	3.69	.56	62.36
5	6	1.36	1.15	1.75	4.26	7.08	2.75	3.12	5.72	2.91	5.66	2.89	.43	39.08
6	31	.37	.87	1.28	3.44	5.84	2.34	2.49	3.55	4.84	4.53	2.50	.45	32.48
7	14	.94	1.32	2.39	6.97	8.48	5.86	4.84	7.82	7.32	7.32	4.94	1.27	59.46
8	13	.79	1.46	2.50	1.49	6.70	3.08	2.95	5.04	5.17	4.70	2.55	.61	41.09
9	73	1.28	2.43	3.60	6.45	9.45	4.13	2.82	5.67	6.87	6.59	3.41	1.27	53.95
10	45	1.02	2.02	3.58	7.37	8.43	4.63	3.34	5.33	7.47	6.32	3.29	1.02	54.00
11	15	.85	2.07	2.76	6.62	8.63	4.76	3.37	6.41	7.11	6.95	4.06	.85	54.45
12	16	.62	.93	1.45	5.13	5.78	1.77	1.33	2.70	4.64	5.07	2.50	.84	33.93
13	29	.76	1.92	2.80	5.93	6.85	5.29	3.06	6.95	5.99	4.39	3.32	1.53	48.78
14	30	.82	1.90	2.17	4.46	7.25	5.11	4.91	5.77	5.51	3.93	2.88	.76	45.46
15	5	.83	.89	1.85	5.41	9.83	6.64	3.35	6.95	7.89	6.80	3.96	.30	54.70
16	13	2.03	2.30	2.91	7.27	15.40	11.85	7.95	10.90	13.41	12.60	5.91	.62	93.15
17	5	.77	2.07	1.86	13.67	17.31	13.47	6.81	14.35	13.18	15.42	5.11	2.60	113.04
18	28	1.82	1.82	2.80	7.43	12.49	7.73	5.25	8.73	9.73	9.08	5.87	1.13	73.68
19	30	2.05	2.57	4.32	7.66	8.91	5.35	4.49	5.35	6.32	6.87	4.21	1.61	59.71
20	30	1.41	1.84	3.66	5.22	8.11	4.86	3.17	5.11	5.43	6.92	3.35	.97	50.05
21	9	2.74	2.43	4.96	7.17	10.53	7.26	4.81	6.32	6.83	6.64	4.72	1.50	65.73
22	6	1.34	1.95	2.79	3.70	8.91	7.09	7.48	8.82	10.78	11.97	6.34	1.33	73.25
23	4	.35	.43	.38	.41	2.47	.70	.27	.87	1.16	3.76	.65	.17	11.62

ILE DE LA GONAVE

Station	Years of record	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Annual
1	9	0.53	0.97	0.78	2.26	8.14	4.65	3.18	5.21	4.56	4.81	1.31	0.43	37.86

DEPARTMENT DE L'ARTIBONITE

Station	Years of record	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Annual
1	23	1.21	1.32	1.17	2.55	6.46	4.75	3.27	4.38	4.05	4.70	4.85	1.79	40.49
2	15	.78	1.26	.67	3.82	6.60	5.34	3.98	3.20	5.08	3.95	3.87	1.47	40.00
3	13	.37	1.30	1.24	4.06	7.18	9.24	6.42	6.84	7.73	5.55	4.75	.78	55.46
4	46	.19	.50	.63	1.11	3.24	3.72	2.92	6.30	3.26	2.22	1.12	.39	21.95
5	15	.80	.98	1.02	3.31	7.02	7.17	4.26	4.73	6.22	5.47	4.08	.47	45.51
6	13	.41	.60	.40	1.40	3.74	3.98	4.61	4.68	4.89	6.73	2.30	.07	32.87
7	13	.23	.61	.47	2.48	3.84	4.70	3.71	5.45	3.58	2.29	1.76	.57	29.66
8	11	.62	.71	.17	2.33	4.21	5.26	4.70	5.13	4.83	2.84	1.12	.59	32.38
9	15	.48	.66	.93	1.74	4.38	10.47	8.55	8.19	7.63	5.45	1.56	.07	50.11
10	31	.60	.98	.59	2.66	4.65	5.17	5.11	4.63	4.90	4.06	1.19	.38	34.90
11	15	.43	1.01	.56	2.08	4.96	6.58	4.87	5.78	5.66	4.79	1.40	.26	38.39
12	15	.33	.76	.60	2.83	8.10	10.36	8.42	7.67	6.93	5.58	1.65	.47	53.67
13	15	.19	.94	.72	3.93	7.61	8.50	6.76	8.60	7.11	6.50	1.33	.46	62.65
14	15	.41	1.65	1.21	4.07	10.12	11.17	8.56	10.99	7.96	8.11	2.48	.48	67.00

DEPARTMENT DU NORD-OUEST

Station	Years of record	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Annual
1	31	1.36	2.34	1.09	1.72	2.43	1.94	1.03	1.32	2.48	2.52	3.48	1.72	23.42
2	14	2.70	2.60	2.26	2.62	4.74	3.89	1.29	1.33	3.73	3.60	7.34	2.80	38.89
3	29	4.97	3.42	2.56	2.55	3.42	3.32	2.43	3.25	4.71	4.87	8.67	5.14	49.30
4	12	6.37	4.79	4.13	6.18	5.72	3.45	3.15	5.40	3.56	7.61	16.02	9.00	76.76

DEPARTMENT DU NORD

Station	Years of record	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Annual
1	22	7.12	5.39	5.14	6.93	6.17	3.94	2.76	2.65	4.40	8.30	14.51	7.63	74.93
2	18	4.58	4.67	4.43	7.28	8.21	4.35	1.79	3.62	5.50	8.74	15.10	11.14	77.93
3	20	2.48	3.37	2.91	5.38	9.15	8.53	5.12	8.51	7.38	7.69	8.47	4.22	73.20
4	17	2.66	3.29	2.67	4.90	9.13	7.83	5.65	6.32	10.60	8.40	9.20	4.61	75.65
5	15	5.93	5.51	4.85	6.87	8.52	5.21	4.13	4.15	6.24	7.90	14.85	7.00	81.16
6	26	4.59	4.37	4.04	3.24	5.83	3.64	1.42	1.78	3.85	8.17	11.92	7.02	54.97
7	6	2.71	3.55	5.19	5.23	7.13	2.45	1.91	3.00	5.16	4.44	13.34	4.60	61.00
8	15	3.70	3.38	3.83	4.24	7.43	4.14	2.82	3.15	5.54	5.38	10.67	3.60	57.87
9	5	2.49	2.52	2.36	3.48	6.04	6.31	3.60	4.01	6.48	6.07	8.95	4.56	56.89
10	4	1.34	1.57	1.98	4.70	5.65	5.38	.98	2.75	4.61	2.19	7.10	1.30	39.63
11	5	.60	3.43	2.70	4.72	6.46	6.28	1.14	2.62	3.39	4.04	8.10	2.49	46.34
12	15	1.39	1.46	1.35	3.05	8.04	6.63	4.33	4.93	8.11	5.26	5.91	1.26	51.71
13	4	4.40	3.65	3.18	3.75	13.78	14.04	7.92	7.54	11.21	7.61	11.25	5.17	83.50
14	34	2.61	2.52	3.00	3.86	7.04	4.33	2.78	4.20	6.14	5.64	7.94	4.08	54.15
15	8	1.36	.59	2.04	2.03	5.67	6.31	4.58	5.56	6.52	8.44	4.31	2.76	50.17
16	9	2.43	1.61	2.54	4.20	6.52	4.57	4.00	3.97	5.29	6.62	6.88	5.47	52.10
17	9	.79	.74	.74	3.57	4.80	5.31	3.85	3.45	4.26	3.26	2.31	.61	34.23
18	14	3.56	3.07	3.97	4.80	10.40	7.22	5.14	7.53	8.02	9.53	10.10	3.87	77.21
19	28	.49	.56	1.54	2.97	7.70	7.61	4.60	5.08	6.58	4.99	2.47	.71	45.31
20	15	.54	1.66	1.82	5.48	14.97	12.66	7.78	8.02	10.65	8.05	2.65	.84	75.11
21	18	.49	.79	1.24	5.72	10.37	8.95	7.08	6.21	7.84	6.95	1.36	.63	57.63
22	15	.62	.82	2.00	4.40	7.20	5.43	3.75	4.88	5.20	5.36	2.32	.41	42.38

CALIBRATION OF A WEATHER BUREAU TIPPING-BUCKET RAINGAGE

By Donald A. Parsons

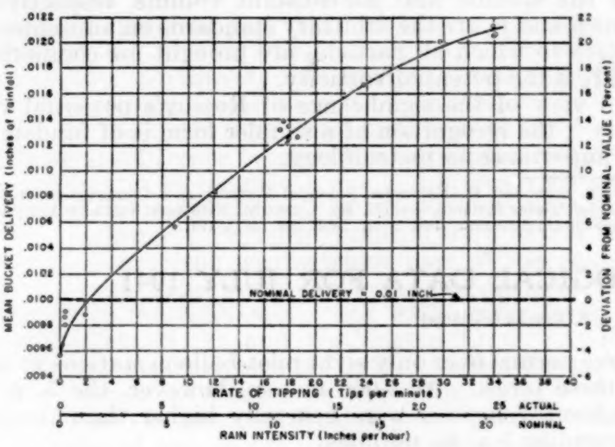
[Hydrologic Division, Soil Conservation Service, Auburn, Ala., July 1940]

In the course of instrumentation research conducted by the Soil Conservation Service, a standard United States Weather Bureau tipping-bucket raingage was calibrated. Since all of the longer records of rainfall intensity in the United States were obtained with this instrument, the results of this calibration are here presented for the benefit of those called upon to interpret Weather Bureau records of rainfall intensity.

The gage calibrated was furnished by the United States Weather Bureau and bore Bureau Serial No. 347. The instrument was manufactured by Julien P. Friez & Sons in May 1918.

The calibration was made by the Soil Conservation Service. Facilities for the work were provided by the National Bureau of Standards, Washington, D. C.

In calibrating the gage, a steady flow of water was discharged into the funnel. The rate of tipping was determined by counting the number of tips during a measured time interval. The rate of flow was obtained



by weighing the water discharged during the measured time intervals.

The calibration derived from the tests is shown on the accompanying diagram. It is evident from this graph that when the bucket is tipping at a rate of about two tips per minute, it delivers 0.01 inch of rainfall at each tip. For faster rates of tipping the delivery of the bucket is greater than 0.01 inch, and for slower rates is less than this amount. In other words, the records of intensities higher than 1.2 inches per hour are too low and the records of lesser intensities exceed the actual rates. This tendency was pointed out by B. C. Kadel, "Measurement of Precipitation," W. B. *Circular* E, 4th ed., 1936, pp. 10–11.

The percentage deviation of the "nominal" from the "actual" intensity of rainfall is indicated by the scale on the right hand side of the accompanying diagram. The nominal rate is equal to .01, the nominal bucket delivery in inches of rainfall, times the number of tips which would occur in one hour at the given rate of tipping. To obtain the actual intensity, multiply the nominal rate by the factor, 100 times actual bucket delivery, the actual delivery being taken from the left hand scale of the diagram. The portion of the curve beyond 25 tips per minute has no practical significance, since natural rainfall almost never occurs at even this rate; the purpose in carrying the graph out so far was to show the group data points at about 34 tips per minute, which of course help in locating the curve at lower rates.

The Soil Conservation Service has investigated several tipping-bucket devices of different sizes and shapes. As a result of this work, it has been concluded that if all tipping-bucket instruments of a given design are adjusted to deliver the same quantity of water at a given rate of tipping, the delivery of all of the gages will be substantially the same at all other rates of tipping.

The principal condition necessary for the maintenance of a given calibration is an unchanging moment of force of the empty bucket about the fulcrum. This moment will be changed if any of the following alterations are made:

1. A change in the angle through which the bucket tips.
2. A shift in the center of gravity relative to the fulcrum.
3. A change in the weight of the bucket.

To reduce the labor required to convert reported rates to actual intensities, the accompanying table was prepared. While it may be considered exact for only the particular gage calibrated, it is obvious from the foregoing that it can be used with considerable confidence for all gages of the same pattern, provided all of these gages have been adjusted to deliver 0.01 inch of rain when the rate of tipping is about two tips per minute. It is the standard practice of the manufacturer to adjust all instruments to this delivery before they leave the factory. If they have not been readjusted or altered in the field the conversion table should, therefore, be applicable.

The foregoing applies only to determinations of rainfall rates, and has no bearing upon the measurement of total amounts. This has customarily been done independently of the tipping-bucket mechanism with measuring tube and stick.

RAIN INTENSITY

(W. B. Tipping-Bucket Raingage No. 347)

[Inches per hour]

Tips per minute	0.0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9
0	0.00	0.06	0.12	0.17	0.23	0.29	0.35	0.41	0.47	0.53
1	.59	.65	.71	.77	.83	.89	.95	1.01	1.07	1.14
2	1.20	1.26	1.32	1.38	1.44	1.51	1.57	1.63	1.69	1.76
3	1.82	1.88	1.94	2.01	2.07	2.13	2.19	2.26	2.32	2.38
4	2.44	2.51	2.57	2.64	2.70	2.77	2.83	2.89	2.95	3.02
5	3.08	3.15	3.21	3.28	3.34	3.41	3.47	3.54	3.60	3.67
6	3.73	3.80	3.86	3.93	3.99	4.06	4.12	4.19	4.25	4.32
7	4.38	4.45	4.52	4.59	4.65	4.72	4.78	4.85	4.91	4.98
8	5.05	5.12	5.19	5.26	5.32	5.39	5.45	5.52	5.59	5.66
9	5.72	5.79	5.86	5.93	6.00	6.07	6.14	6.21	6.27	6.34
10	6.41	6.48	6.54	6.61	6.68	6.75	6.82	6.89	6.96	7.03
11	7.10	7.17	7.24	7.31	7.38	7.45	7.52	7.59	7.66	7.73
12	7.80	7.87	7.95	8.02	8.09	8.16	8.23	8.30	8.37	8.45
13	8.52	8.59	8.66	8.73	8.80	8.87	8.94	9.01	9.09	9.16
14	9.24	9.31	9.38	9.45	9.53	9.60	9.67	9.74	9.82	9.89
15	9.96	10.04	10.11	10.19	10.26	10.34	10.41	10.48	10.55	10.62
16	10.69	10.77	10.85	10.92	11.00	11.07	11.15	11.22	11.29	11.37
17	11.44	11.52	11.59	11.67	11.75	11.83	11.89	11.96	12.04	12.12
18	12.19	12.27	12.34	12.42	12.50	12.57	12.64	12.72	12.80	12.88
19	12.95	13.03	13.11	13.19	13.26	13.34	13.41	13.49	13.57	13.65
20	13.72	13.80	13.88	13.96	14.03	14.11	14.18	14.26	14.33	14.41
21	14.48	14.56	14.64	14.72	14.79	14.87	14.94	15.02	15.10	15.18
22	15.26	15.34	15.41	15.49	15.56	15.64	15.73	15.81	15.88	15.95
23	16.04	16.12	16.19	16.27	16.34	16.42	16.50	16.58	16.65	16.73
24	16.80	16.88	16.96	17.04	17.13	17.20	17.28	17.36	17.44	17.52

Rating derived from tests made by the Soil Conservation Service at the Hydraulic Laboratory of the National Bureau of Standards.

AN ALTERNATIVE FORM OF POTENTIAL VORTICITY

By H. ARAKAWA

[Central Meteorological Observatory, Tokyo, June 1941]

Potential vorticity ζ_0 is defined by C. G. Rossby [1] as the vorticity which a column of air between two isentropic surfaces would have if it were brought to an arbitrary "standard" latitude and then stretched or shrunk to an arbitrary "standard" thickness. If f is the Coriolis parameter $2\omega \sin \varphi$ at a given latitude φ, and ζ the actual vorticity of an air column of thickness D at its observed position, then from Rossby's vorticity theorem we have

$$\frac{f+\zeta}{D}=\frac{f_0+\zeta_0}{D_0}, \tag{1}$$

where ζ_0 is the vorticity which the air column would have if brought to a latitude where the Coriolis parameter has the value f_0, and to a thickness D_0. If f_0 and D_0 are the adopted standards of comparison, ζ_0 is the potential vorticity, a term chosen by analogy with potential temperature.

In a previous paper [2] the present author has presented results of an investigation in which a newly-defined type of potential temperature was employed. In that paper a potential vorticity of air *particles*, not of air *columns*, was introduced; it is defined as the vorticity which a particle of air would have if it were brought to an arbitrary "standard" latitude and to an arbitrary "standard" density. The author has shown that if ρ is the density.

$$\frac{f+\zeta}{\rho}=\frac{f_0+\zeta_0}{\rho_0}, \tag{2}$$

where ζ_0 is the potential vorticity which an air particle would have if brought to a standard latitude, and to a standard density ρ_0. This type of potential vorticity as a conservative element for identification purposes seems to be better than that of Rossby, because the analysis does not involve the concept of a column of air.

To apply this quantity to isentropic analysis, assuming isentropic flow, equation (2) may be written

$$\frac{f+\zeta}{p^{c_v/c_p}}=\frac{f_0+\zeta_0}{p_0^{c_v/c_p}}, \tag{3}$$

where c_p and c_v are the specific heat at constant pressure and the specific heat at constant volume, respectively. Thus f_0 and p_0 are the arbitrary standards on an isentropic surface to which all particles are brought for comparison and ζ_0 is the potential vorticity.

In view of the significance of Rossby's potential vorticity [3], the recognition of a simpler form is of fundamental importance in meteorology.

[1] C. G. Rossby: Planetary Flow Patterns in the Atmosphere, *Quarterly Journal of the Royal Meteorological Society*, *66*, Supplement, 1940, p. 72.

[2] H. Arakawa: Die Wirbelgleichungen mit Berücksichtigung der Erddrehung, *Meteorol. Zeitschr.*, 1941, Heft 2. Herein a slight misprint occurred; in example 2 and example 4, change "$\frac{\partial u}{\partial x}$ and $\frac{\partial v}{\partial y}$" to "$\frac{\partial w}{\partial x}$ and $\frac{\partial w}{\partial y}$".

[3] V. P. Starr and M. Neiburger: Potential Vorticity as a Conservative Property, *Journal of Marine Research*, Vol. III, No. 3, 1940; M. Neiburger: Vorticity Analysis of a Thunderstorm Situation, *Bull. Amer. Mett. Soc.*, *22*, 1, 1941.

METEOROLOGICAL AND CLIMATOLOGICAL DATA FOR JULY 1941

[Climate and Crop Weather Division, J. B. KINCER in charge]

AEROLOGICAL OBSERVATIONS

By EARL C. THOM

The mean surface temperatures for July were above normal over most of the country. Temperatures were slightly below normal, however, in a considerable part of the Southern Plateau region and at four scattered stations in the eastern half of the country. At all stations in other sections of the country temperatures were above normal, with values considerably above normal over the north-central and the northwestern areas, departures for the month being from +6° to +8° F. over parts of Washington and Oregon.

At 1,500 meters above sea level the 5 a. m. resultant winds for July were from directions to the north of normal over the extreme northeast, the upper Gulf region, and over parts of the central and northwestern sections, and from south of normal at this level over the rest of the country. At 3,000 meters the morning resultant winds for July were more northerly than normal over most of the northeast, over a considerable part of the Western Plains States, and over a strip of the Rocky Mountains along the Great Divide, and were more southerly than normal elsewhere. When the 5 p. m. resultant winds for the month at the 5,000 meter level are compared with the corresponding 5 a. m. normals it is noted that the late afternoon resultants were more southerly than the corresponding morning winds at about two-thirds of the stations for which these data could be compared.

At both the 1,500 m. and 3,000 m. levels the resultant velocities were below normal over most stations, being above normal over only eight pilot-balloon stations at each of these levels. At 5,000 meters, however, the 5. p. m. resultant velocities were generally higher than the corresponding 5 a. m. normals.

At 1,500 meters the 5 p. m. resultant winds were from more northerly directions than were the corresponding 5 a. m. winds over most of the Rocky Mountain and Plateau regions and over a considerable part of the Mississippi River Valley and the Gulf coast, while a turning to the southward during the day was noted at this level over the rest of the country. At 3,000 meters the resultants turned to the northward during the day over a considerable portion of the country. The opposite shift during the day was noted at this level over most stations along the Atlantic Coast, over the northern Plateau and Great Plains regions, and over two stations to the southward.

The 5 p. m. resultant velocities for the month were higher than the corresponding 5 a. m. velocities over the extreme west and over part of the extreme southeast and were lower at this level over most of other pilot-balloon stations of the country. At 3,000 meters the resultant velocities in the late evening were lower than those in the early morning over 10 widely scattered stations. An increase in resultant velocity occurred during the day at this level over all other stations.

The upper-air data discussed above are based on 5 a. m. (eastern standard time) pilot-balloon observations (charts VIII & IX) as well as on observations made at 5 p. m. (table 2 and charts X and XI).

Radiosonde and airplane stations located in the southern

part of the country recorded on the average the highest daily pressures at each of the several standard levels from 2,000 meters to 18,000 meters. The highest mean monthly pressure occurred over both San Antonio and Miami for the 2,000-meter level, over Miami for the 2,500-meter level, over San Antonio for the 3,000-meter level, and over Phoenix for the standard levels 4,000, 6,000, and 7,000 meters. The highest mean pressure for the month occurred over both Phoenix and San Antonio at 5,000 meters as well as at each of the standard levels from 8,000 meters to 15,000 meters, inclusive. At 16,000 meters the highest mean pressure, 114 mb., occurred over Phoenix, San Antonio and San Diego with San Diego recording the maximum pressure at the next two higher levels. The lowest mean monthly pressure occurred over Sault Ste. Marie for each of the standard levels from 2,000 meters to 6,000 and again at 8,000 meters and 16,000 meters. The corresponding minima occurred over Seattle at the 11000-, 12,000- and 13,000-meter levels, while these minima occurred over two or more northern stations at each of the other standard levels from 7,000 meters to 18,000 meters.

With but few scattered exceptions mean pressures for July were higher than those in June over all stations and at all levels up to and including 19,000 meters. This increase in pressure over that of last month was well marked in the western half of the country, especially in the extreme northwest, for example, at Medford the average increase in mean pressure from June to July was 11 mb. for the levels from 4,000 meters to 12,000 meters. The largest difference between the highest and the lowest mean pressures for the month was 11 mb. which was noted at each of the standard levels from 6,000 meters to 11,000 meters, inclusive. Pressure gradients were not as steep as in June over the northwestern part of the country. The steepest upper level pressure gradient, for July, occurred at the 8,000-meter and 9,000-meter levels between Buffalo, N. Y., and Washington, D. C. At these levels there was a change of 1 mb. pressure for each 53 miles of horizontal distance between these cities.

The mean temperatures for June were generally higher than those of last month from the surface up to and including 11,000 meters. The only exception to this increase in temperatures occurred at Pensacola and Brownsville at levels from 2,000 meters to 11,000 meters. At most of the standard levels from 12,000 meters to 19,000 meters temperatures were lower than last month over the western half of the country, while increases and decreases of temperatures were well distributed to the eastward. At only two stations, Sault Ste. Marie and Miami, were free-air temperatures higher than last month at all levels.

Comparison of the mean temperature charts for July 1941 with those for July 1940 show the temperatures this year to be the higher over a considerable portion of the country from the surface up to 11,000 meters. Temperatures at these levels were lower than last year along the Gulf Coast and over most of the Rocky Mountain and Southern Plateau regions. Above 11,000 meters temperatures were lower than last year at most levels over the northeast and were generally higher over the rest of the country.

The mean temperatures for July at 1,000 meters were somewhat above normal over most of the western half of the country and over all but one station in the northeast and were below normal elsewhere. At 3,000 meters temperatures were above normal generally over the eastern third of the country and over most of the extreme north-central and middle-plateau regions, and were generally below normal over other areas at this level. Temperatures at the 5,000 m. level were above normal over most stations in the eastern two-thirds of the country while they were below normal at this level over all stations to the westward.

The mean relative humidities for the month at the 1,000 m., 3,000 m., and 5,000 m., levels were normal or above over most of the country. Humidities were, however, below normal over the Southwest, at all three levels, over Sault Ste. Marie at the two lower levels and also below normal over the extreme Northwest at 1,000 meters.

The altitude at which the mean monthly temperature of 0° C. for July occurred, varied from the lowest (3,900 meters) over Seattle, Wash., to the highest (5,000 meters) over San Antonio, Tex. The level at which, on the average, freezing conditions occurred was higher than last month over all of the United States with the exception of Brownsville where it was slightly lower. This level was much higher than last month over the upper Pacific coast, being 1,500 meters higher over Medford, Oreg., and 1,200 meters higher over Seattle.

The lowest free-air temperature recorded during the month over United States was −79.9° C. (−111.8° F.). This temperature occurred over Brownsville, Tex., on the morning of July 7, at an altitude of 17,400 meters (about 10.8 miles) above sea level. (In this connection a temperature of −85.0° C. was reported as having been recorded over Phoenix on July 2, 1941. This minimum is not well supported by surrounding stations and has not been verified. It has not, therefore, been accepted as official). The lowest temperature for the month over San Juan was −81.4° C. (−114.5° F.) which was observed at 16,400 meters (about 10.2 miles) above sea level on the morning of July 24.

Table 3 shows the maximum free-air wind velocities and their directions for various sections of the United States during July as determined by pilot-balloon observations. The highest observed wind velocity for the month was 68 m. p. s. (152 miles per hour) observed over Evansville, Ind., on July 2. This wind was blowing from the southwest at an elevation of 4,170 meters (about 2.6 miles) above sea level.

The highest July wind velocity observed during the last 5 years in the free-air layer from the surface to 2,500 meters was 43.0 m. p. s. (96 miles per hour), observed on July 11, 1941, over Cheyenne, Wyo. (see table 3). The wind velocity of 68 m. p. s. over Evansville (reported in table 3 and in the previous paragraph) on July 2 this year was the highest observed in the layer from 2,500 meters to 5,000 meters while during this 5-year period a still higher wind velocity, 84.0 m. p. s. (188 miles per hour), was observed in July in the free-air above the 5,000-meter level. This wind was observed on July 6, 1939, over Redding, Calif., and was blowing from the west at an elevation of 19,710 meters (about 12.2 miles).

TABLE 1.—*Mean free-air barometric pressure in millibars, temperature in degrees Centigrade, and relative humidities in percent, obtained by airplanes and radiosondes during July 1941*

Stations with elevations in meters above sea level

Altitude (meters) m. s. l.	Albuquerque, N. Mex. (1,620 m.)				Atlanta, Ga. (300 m.)				Bismarck, N. Dak. (505 m.)				Boise, Idaho (864 m.)			
	Number of observations	Pressure	Temperature	Relative humidity	Number of observations	Pressure	Temperature	Relative humidity	Number of observations	Pressure	Temperature	Relative humidity	Number of observations	Pressure	Temperature	Relative humidity
Surface	30	841	21.6	52	31	982	23.1	91	31	955	19.7	73	25	915	21.5	49
500	----	----	----	----	31	960	23.2	85	----	----	----	----	----	----	----	----
1,000	----	----	----	----	31	907	21.4	81	31	903	23.3	60	25	901	24.7	44
1,500	----	----	----	----	31	856	18.5	78	31	852	20.4	61	25	851	23.2	36
2,000	30	805	20.6	49	31	807	15.6	76	31	804	16.9	63	25	803	19.2	37
2,500	30	759	17.2	50	31	761	12.8	73	31	758	13.4	63	25	757	15.1	39
3,000	30	716	13.4	53	31	717	9.9	71	31	714	10.2	62	25	713	11.0	42
4,000	30	635	5.6	62	31	635	4.2	69	31	632	3.8	56	25	632	3.0	50
5,000	29	561	−2.1	70	31	561	−1.1	62	31	558	−2.7	49	25	558	−4.1	53
6,000	29	494	−8.6	70	31	495	−6.7	57	30	492	−9.5	46	25	490	−11.1	51
7,000	28	434	−14.5	65	31	435	−13.1	52	30	431	−16.6	44	25	430	−18.6	49
8,000	28	380	−20.9	60	31	380	−19.9	51	30	377	−24.0	43	25	375	−26.0	47
9,000	27	330	−28.1	56	31	332	−27.1	50	30	327	−31.6	42	23	326	−33.4	46
10,000	27	287	−35.3	54	31	288	−34.9	48	29	284	−39.2	42	23	282	−41.0	----
11,000	26	248	−42.7	----	31	249	−43.0	----	29	245	−46.6	----	22	243	−47.9	----
12,000	26	214	−49.4	----	30	215	−50.8	----	29	210	−52.4	----	22	208	−54.0	----
13,000	26	183	−56.0	----	30	184	−58.2	----	28	180	−55.3	----	22	178	−56.6	----
14,000	26	156	−62.0	----	29	156	−64.1	----	27	154	−57.4	----	22	152	−56.9	----
15,000	25	132	−66.7	----	29	132	−66.5	----	27	131	−58.3	----	20	130	−57.9	----
16,000	24	112	−68.7	----	29	112	−67.4	----	26	112	−58.0	----	20	111	−58.5	----
17,000	23	95	−66.7	----	26	95	−66.0	----	24	95	−57.6	----	18	94	−58.5	----
18,000	20	81	−63.2	----	21	80	−63.6	----	21	81	−56.7	----	18	80	−58.0	----
19,000	10	69	−60.5	----	15	69	−60.1	----	14	70	−55.6	----	15	69	−57.0	----
20,000	----	----	----	----	----	----	----	----	8	59	−54.6	----	6	58	−55.2	----
21,000	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----

Altitude (meters) m. s. l.	Brownsville, Tex. (6 m.)				Buffalo, N. Y. (221 m.)				Charleston, S. C. (14 m.)			
	Number of observations	Pressure	Temperature	Relative humidity	Number of observations	Pressure	Temperature	Relative humidity	Number of observations	Pressure	Temperature	Relative humidity
Surface	31	1,014	26.5	89	31	989	19.7	78	31	1,015	24.4	94
500	31	959	24.8	82	31	958	20.6	70	31	960	23.9	86
1,000	31	906	22.5	71	31	904	18.2	70	31	907	21.2	80
1,500	31	855	19.9	64	31	852	14.8	74	31	856	18.3	77
2,000	31	806	17.0	58	31	803	11.7	68	31	807	15.1	75
2,500	31	760	14.2	54	31	756	9.1	61	31	761	12.1	72
3,000	31	716	11.2	50	31	711	6.1	58	31	716	9.2	70
4,000	31	635	5.4	48	31	629	0.6	50	30	634	3.8	63
5,000	31	562	−.7	48	31	555	−5.2	46	29	561	−1.9	60
6,000	30	495	−6.8	45	31	488	−11.5	43	29	494	−7.4	58
7,000	29	435	−13.5	44	31	428	−18.1	40	29	434	−13.4	55
8,000	29	380	−20.3	43	31	373	−25.1	39	29	380	−20.4	52
9,000	29	331	−27.4	42	31	324	−32.3	40	28	331	−27.6	50
10,000	29	288	−34.5	41	31	281	−40.0	----	27	288	−35.1	46
11,000	28	249	−42.3	----	30	242	−47.6	----	27	249	−43.0	----
12,000	27	215	−50.1	----	30	208	−54.4	----	27	214	−50.8	----
13,000	27	184	−57.6	----	30	177	−58.3	----	27	183	−58.5	----
14,000	27	156	−64.5	----	28	151	−60.3	----	27	156	−64.3	----
15,000	27	132	−69.6	----	26	129	−61.5	----	27	132	−67.4	----
16,000	27	112	−71.2	----	24	110	−61.5	----	27	112	−68.5	----
17,000	26	95	−69.5	----	20	93	−60.7	----	24	95	−66.6	----
18,000	22	80	−66.1	----	15	80	−59.2	----	21	80	−63.6	----
19,000	19	68	−62.5	----	----	----	----	----	10	68	−61.2	----
20,000	13	58	−59.6	----	----	----	----	----	----	----	----	----
21,000	5	49	−56.7	----	----	----	----	----	----	----	----	----

Stations with elevations in meters above sea level

Altitude (meters) m. s. l.	Denver, Col. (1616 m.)				El Paso, Tex. (1193 m.)				Ely, Nev. (1908 m.)				Great Falls, Mont. (1128 m.)			
	Number of observations	Pressure	Temperature	Relative humidity	Number of observations	Pressure	Temperature	Relative humidity	Number of observations	Pressure	Temperature	Relative humidity	Number of observations	Pressure	Temperature	Relative humidity
Surface	28	842	18.8	63	28	883	24.0	55	31	812	15.1	52	31	888	19.8	54
500	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
1,000	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
1,500	----	----	----	----	28	853	24.2	51	----	----	----	----	31	851	20.0	50
2,000	28	805	19.7	51	28	805	21.6	52	31	804	18.0	49	31	802	16.6	49
2,500	28	759	16.9	50	28	760	17.9	54	31	758	17.4	42	31	756	12.6	50
3,000	28	716	13.3	50	28	716	13.9	58	31	715	13.8	41	31	712	8.6	55
4,000	28	635	5.2	59	28	635	6.3	65	31	634	5.2	45	31	630	1.4	61
5,000	28	561	−2.6	68	28	562	−1.0	72	31	560	−3.0	52	31	556	−5.3	60
6,000	27	494	−9.5	65	28	495	−7.2	70	31	492	−10.8	52	30	489	−11.6	58
7,000	27	433	−16.2	57	28	435	−12.8	60	31	432	−17.5	50	30	428	−18.7	56
8,000	25	378	−23.4	53	28	381	−19.3	54	31	377	−24.6	48	29	374	−26.5	55
9,000	24	329	−30.9	52	28	332	−26.5	51	31	328	−32.3	47	29	325	−34.1	55
10,000	24	286	−38.8	47	27	289	−33.8	50	30	284	−40.2	----	29	281	−41.9	----
11,000	24	246	−46.7	----	27	250	−41.4	----	30	244	−47.7	----	29	242	−49.2	----
12,000	22	211	−53.7	----	27	215	−49.0	----	30	210	−53.2	----	28	207	−54.5	----
13,000	17	180	−57.9	----	27	184	−56.6	----	30	180	−56.9	----	28	177	−57.1	----
14,000	17	154	−61.0	----	27	157	−63.6	----	30	153	−59.5	----	28	151	−58.0	----
15,000	15	130	−63.0	----	27	133	−68.9	----	29	130	−62.0	----	26	129	−58.2	----
16,000	14	111	−63.4	----	26	113	−70.9	----	29	111	−63.4	----	23	110	−58.4	----
17,000	11	94	−62.7	----	25	95	−68.0	----	26	94	−62.5	----	22	94	−57.5	----
18,000	5	80	−60.3	----	22	80	−64.2	----	19	80	−61.3	----	20	80	−56.8	----
19,000	----	----	----	----	16	68	−60.7	----	9	68	−59.9	----	17	68	−55.9	----
20,000	----	----	----	----	6	58	−57.3	----	----	----	----	----	8	58	−54.9	----

Altitude (meters) m. s. l.	Huntington, W. Va. (172 m.)				Lakehurst, N. J.[1] (39 m.)				Medford, Ore. (401 m.)			
	Number of observations	Pressure	Temperature	Relative humidity	Number of observations	Pressure	Temperature	Relative humidity	Number of observations	Pressure	Temperature	Relative humidity
Surface	15	995	20.2	93	30	1,010	19.3	90	31	967	22.7	47
500	15	959	24.1	74	30	958	19.9	79	31	956	24.3	46
1,000	15	905	21.4	69	30	904	18.5	74	31	903	22.0	46
1,500	15	854	18.4	65	30	853	16.0	72	31	853	19.0	49
2,000	15	806	15.8	63	30	804	13.4	70	31	804	16.2	52
2,500	15	759	12.8	56	30	758	10.7	70	31	758	13.5	50
3,000	15	715	9.6	54	30	713	8.0	68	31	714	10.6	49
4,000	15	633	4.2	51	30	631	2.5	60	31	632	3.7	48
5,000	14	560	−1.0	46	29	558	−2.9	58	31	558	−2.4	43
6,000	14	493	−6.8	43	28	491	−8.2	51	31	492	−9.6	42
7,000	13	433	−13.1	41	27	432	−14.5	46	30	431	−17.2	42
8,000	13	379	−20.4	40	27	376	−21.4	48	30	376	−24.8	40
9,000	12	330	−27.7	39	27	327	−29.2	50	30	327	−32.5	39
10,000	12	287	−35.1	----	27	284	−36.9	51	30	284	−39.8	38
11,000	12	248	−43.0	----	27	245	−44.6	----	30	244	−47.1	----
12,000	12	214	−50.7	----	27	210	−52.3	----	30	219	−52.9	----
13,000	12	183	−57.4	----	27	180	−58.4	----	29	180	−55.0	----
14,000	12	156	−62.6	----	25	154	−62.0	----	29	153	−56.1	----
15,000	12	132	−64.3	----	22	131	−63.8	----	29	131	−57.5	----
16,000	11	112	−64.5	----	20	111	−64.2	----	27	112	−58.6	----
17,000	11	95	−62.8	----	17	94	−63.0	----	23	96	−58.4	----
18,000	10	81	−60.8	----	12	79	−60.9	----	14	81	−58.1	----
19,000	7	69	−59.2	----	7	66	−58.3	----	7	69	−57.4	----
20,000	----	----	----	----	----	----	----	----	----	----	----	----

See footnotes at end of table.

TABLE 1.—*Mean free-air barometric pressure in millibars, temperature in degrees Centigrade, and relative humidities in percent, obtained by airplanes and radiosondes during July 1941*—Continued

Altitude (meters) m. s. l.	Miami, Fla. (4 m.)				Nashville, Tenn. (180 m.)				Norfolk, Va.[1] [2] (10 m.)				Oakland, Calif. (2 m.)				Oklahoma City, Okla. (391 m.)				Omaha, Nebr. (301 m.)				Pensacola, Fla.[1] (24 m.)			
	Number of observations	Pressure	Temperature	Relative humidity	Number of observations	Pressure	Temperature	Relative humidity	Number of observations	Pressure	Temperature	Relative humidity	Number of observations	Pressure	Temperature	Relative humidity	Number of observations	Pressure	Temperature	Relative humidity	Number of observations	Pressure	Temperature	Relative humidity	Number of observations	Pressure	Temperature	Relative humidity
Surface	31	1,017	24.6	92	31	994	23.8	84	22	1,016	23.8	89	31	1,014	15.7	84	31	970	24.2	77	31	980	22.4	77	20	1,015	26.6	86
500	31	962	23.4	88	31	959	24.6	75	22	960	23.7	76	31	957	18.4	67	31	958	25.4	72	31	958	23.6	67	20	962	23.7	83
1,000	31	908	20.4	83	31	905	21.8	74	22	907	21.3	75	31	903	22.3	41	31	905	24.5	65	31	904	22.5	60	20	907	20.9	78
1,500	31	857	17.6	80	31	855	18.3	76	22	856	18.5	74	31	852	20.5	34	31	855	21.2	68	31	854	19.6	58	20	856	18.0	75
2,000	31	808	14.8	77	31	806	15.2	76	22	807	15.8	72	31	804	17.3	30	31	807	17.9	67	31	805	16.4	58	20	807	14.8	73
2,500	31	762	12.2	73	31	760	12.0	69	22	760	13.1	67	31	757	14.1	26	31	760	14.2	66	31	759	13.4	56	20	761	11.9	71
3,000	31	717	9.8	68	31	715	9.3	64	22	716	10.2	63	31	713	10.8	24	31	717	10.7	67	31	715	10.0	57	20	716	9.2	68
4,000	31	636	4.4	62	31	634	3.9	58	21	634	3.7	64	31	632	4.2	22	31	635	4.3	59	31	633	3.5	61	20	635	3.5	63
5,000	31	562	−1.5	64	29	560	−1.6	52	20	560	−2.7	60	31	558	−2.7	20	31	561	−1.5	55	31	560	−2.3	56	20	560	−2.4	60
6,000	30	495	−7.5	62	27	493	−7.5	48					31	491	−10.4	19	31	494	−7.1	48	31	493	−8.5	49	19	493	−8.5	58
7,000	30	434	−14.0	59	27	433	−13.9	45					30	431	−18.2	19	31	434	−13.4	47	30	433	−15.3	45	19	433	−14.7	58
8,000	30	380	−21.0	56	26	379	−20.9	44					30	376	−26.0	19	29	380	−20.2	43	30	378	−22.0	42	15	379	−21.7	55
9,000	30	331	−28.2	53	26	330	−28.2	43					30	326	−33.6	19	27	331	−27.4	41	29	329	−29.2	39	15	329	−29.3	54
10,000	30	287	−35.9	52	25	287	−35.7	42					30	283	−41.0		27	288	−34.8	39	29	286	−36.7	36	14	286	−37.1	
11,000	30	248	−43.6		24	248	−43.5						30	243	−47.6		27	249	−42.6		28	247	−44.3		13	247	−45.8	
12,000	30	214	−51.2		24	213	−51.2						30	209	−52.8		26	214	−49.7		28	212	−51.5		11	212	−54.5	
13,000	30	183	−58.5		24	183	−58.1						30	178	−56.2		26	183	−56.2		28	182	−56.9		6	182	−61.6	
14,000	30	155	−64.6		24	155	−64.0						30	152	−59.2		25	156	−61.8		28	155	−59.9					
15,000	28	132	−68.0		24	132	−66.2						28	130	−61.4		24	133	−65.7		28	132	−62.0					
16,000	28	112	−69.1		22	112	−66.7						26	110	−62.5		22	113	−67.0		26	112	−62.3					
17,000	26	94	−68.3		19	95	−65.0						26	94	−61.9		21	95	−65.8		25	96	−60.9					
18,000	23	79	−66.3		15	80	−62.3						23	79	−60.5		16	80	−62.8		18	81	−59.3					
19,000	18	67	−63.6		7	68	−60.1						20	68	−58.8		13	69	−59.9		11	69	−57.7					
20,000	11	57	−61.5										9	58	−57.2		6	58	−58.2		5	58	−55.4					
21,000	5	48	−58.9																									

Stations with elevations in meters above sea level

Altitude (meters) m. s. l.	Phoenix, Ariz. (339 m.)				Portland, Maine (19 m.)				St. Louis, Mo. (171 m.)				St. Paul, Minn. (225 m.)				San Diego, Calif.[1] (19 m.)				San Antonio, Tex. (174 m.)				S. S. Marie, Mich. (221 m.)			
	Number of observations	Pressure	Temperature	Relative humidity	Number of observations	Pressure	Temperature	Relative humidity	Number of observations	Pressure	Temperature	Relative humidity	Number of observations	Pressure	Temperature	Relative humidity	Number of observations	Pressure	Temperature	Relative humidity	Number of observations	Pressure	Temperature	Relative humidity	Number of observations	Pressure	Temperature	Relative humidity
Surface	31	970	29.1	44	31	1,011	15.9	91	31	995	24.0	70	31	987	21.2	79	30	1,010	19.1	86	31	995	25.4	83	31	988	15.2	89
500	31	953	33.6	35	31	957	18.8	76	31	958	24.3	66	31	956	22.3	70	30	956	20.0	71	31	960	25.5	80	31	956	18.2	74
1,000	31	902	31.9	33	31	902	16.4	70	31	905	21.7	68	31	903	20.7	61	30	902	23.0	41	31	906	24.1	73	31	902	17.0	66
1,500	31	852	28.4	34	31	851	13.4	70	31	854	18.3	73	31	852	17.8	63	30	851	22.5	35	31	856	21.4	71	31	850	14.1	63
2,000	31	805	24.3	37	31	802	10.5	68	31	805	15.2	74	31	804	14.6	63	30	803	20.5	33	31	808	18.4	66	31	801	11.0	61
2,500	31	760	20.0	40	31	755	7.7	64	31	759	11.9	71	31	757	11.5	62	30	757	17.2	34	31	761	15.5	59	31	754	8.1	58
3,000	31	717	15.6	45	31	710	5.1	60	31	715	9.1	64	31	713	8.3	60	30	714	13.8	35	31	718	12.8	52	31	710	5.2	57
4,000	31	637	7.8	50	31	628	0	58	31	633	3.3	57	31	631	2.5	55	30	633	6.3	32	31	636	6.3	51	31	628	0	55
5,000	31	563	.5	52	31	554	−5.2	50	31	559	−2.4	53	31	557	−2.9	51	30	560	−.2	32	31	563	.1	53	31	553	−6.0	51
6,000	31	497	−6.5	52	31	487	−11.3	45	30	492	−8.7	49	30	490	−9.2	47	30	493	−6.6	26	30	496	−6.1	50	30	486	−12.4	47
7,000	31	437	−12.8	46	31	427	−17.7	44	29	432	−15.0	45	30	430	−16.0	42	30	434	−13.0	22	30	436	−12.2	46	29	426	−19.1	43
8,000	30	382	−19.6	42	30	373	−24.6	43	29	378	−22.1	43	30	376	−23.1	40	26	379	−20.6		30	382	−18.6	44	29	371	−26.2	42
9,000	29	333	−26.8	40	29	324	−31.9	41	29	329	−29.1	44	30	326	−30.6	39	26	330	−28.2		30	333	−25.4	43	29	322	−33.7	40
10,000	29	290	−34.1	39	29	281	−39.1		29	286	−36.4	44	30	283	−38.0	38	26	287	−35.3		29	290	−32.7	43	29	279	−40.8	
11,000	28	251	−41.2		29	242	−46.2		29	247	−43.8		30	244	−45.2		25	248	−41.7		29	251	−40.2		29	241	−46.9	
12,000	28	216	−48.1		29	208	−52.5		29	212	−50.7		30	210	−51.2		24	213	−48.3		29	216	−47.6		29	207	−51.3	
13,000	28	185	−54.9		28	178	−56.4		29	182	−57.0		30	180	−54.7		21	183	−54.3		29	185	−55.0		28	177	−54.1	
14,000	26	158	−61.1		27	152	−58.1		26	155	−62.0		30	153	−56.8		21	157	−60.1		28	158	−62.1		27	151	−56.8	
15,000	26	134	−66.5		23	129	−59.2		26	132	−64.4		28	131	−58.5		18	134	−64.5		28	134	−68.1		23	129	−57.9	
16,000	26	114	−70.0		21	110	−58.2		25	112	−65.0		23	112	−58.8		17	114	−67.6		27	114	−70.4		19	109	−57.5	
17,000	25	96	−68.7		19	94	−57.5		24	95	−64.2		21	95	−58.0		14	97	−67.6		27	96	−69.4		16	93	−56.2	
18,000	22	81	−65.8		15	80	−56.1		21	81	−62.4		17	81	−56.7		11	82	−65.9		22	81	−65.9		11	79	−54.5	
19,000	17	69	−62.7		8	69	−54.9		15	69	−59.9		10	69	−55.3		8	69	−63.8		12	69	−62.6		7	67	−52.9	
20,000	6	58	−59.7						13	58	−57.5		7	59	−54.0													
21,000									6	50	−55.8																	

See footnotes at end of table.

TABLE 1.—*Mean free-air barometric pressure in millibars, temperature in degrees Centigrade, and relative humidities in percent, obtained by airplanes and radiosondes during July 1941*—Continued

Stations with elevations in meters above sea level

Altitude (meters) m. s. l.	Seattle, Wash.,[1] (27 m.)				Spokane, Wash. (598 m.)				Washington, D. C. (5 m.)			
	Number of observations	Pressure	Temperature	Relative humidity	Number of observations	Pressure	Temperature	Relative humidity	Number of observations	Pressure	Temperature	Relative humidity
Surface	30	1,013	19.5	68	31	944	21.4	52	30	1,013	22.8	83
500	30	959	18.8	64					30	959	22.7	80
1,000	30	905	16.4	66	31	902	23.9	42	30	906	20.7	77
1,500	30	853	13.6	67	31	851	20.4	40	29	855	18.1	78
2,000	30	804	10.9	63	31	803	16.1	42	28	806	15.2	73
2,500	30	756	8.2	61	31	756	11.7	46	28	759	12.4	70
3,000	30	712	5.5	57	31	712	7.5	49	28	715	9.7	67
4,000	30	629	−.5	48	31	630	.5	52	26	634	3.8	67
5,000	30	554	−6.9	43	31	556	−5.9	50	26	560	−1.8	60
6,000	30	487	−13.3	46	30	488	−12.3	45	24	493	−7.7	54
7,000	30	426	−20.4	51	29	428	−19.5	43	24	433	−14.2	50
8,000	30	372	−27.9	53	28	373	−26.6	42	23	379	−21.4	49

Altitude (meters) m. s. l.	Seattle, Wash.,[1] (27 m.)				Spokane, Wash. (598 m.)				Washington, D. C. (5 m.)			
	Number of observations	Pressure	Temperature	Relative humidity	Number of observations	Pressure	Temperature	Relative humidity	Number of observations	Pressure	Temperature	Relative humidity
9,000	30	322	−35.2	52	27	324	−34.0	42	22	330	−28.7	49
10,000	28	279	−42.3		27	280	−41.8		22	286	−36.4	50
11,000	28	240	−49.3		25	242	−49.4		22	247	−44.7	
12,000	28	206	−54.4		23	207	−55.7		22	212	−51.5	
13,000	27	176	−55.2		20	177	−56.7		19	182	−57.0	
14,000	26	151	−55.8		18	151	−55.2		19	154	−60.1	
15,000	26	130	−56.0		17	129	−55.2		19	132	−62.0	
16,000	25	112	−56.1		17	111	−55.5		18	112	−61.6	
17,000	23	96	−56.1		15	94	−55.6		15	95	−61.5	
18,000	19	81	−55.7		14	81	−55.1		10	80	−59.3	
19,000	14	69	−55.4		7	69	−54.9		6	68	−57.1	
20,000	6	58	−55.6									

Stations with elevations in meters above sea level

Altitude (meters) m. s. l.	Anchorage, Alaska (42 m.)				Atlantic Station No. 1[3] (3 m.)				Atlantic Station No. 2[4] (3 m.)				Coco Solo, C. Z.[1,2] (15 m.)				Fairbanks, Alaska (156 m.)				Juneau, Alaska (49 m.)				Ketchikan, Alaska (26 m.)			
	Number of observations	Pressure	Temperature	Relative humidity	Number of observations	Pressure	Temperature	Relative humidity	Number of observations	Pressure	Temperature	Relative humidity	Number of observations	Pressure	Temperature	Relative humidity	Number of observations	Pressure	Temperature	Relative humidity	Number of observations	Pressure	Temperature	Relative humidity	Number of observations	Pressure	Temperature	Relative humidity
Surface	31	1,008	15.0	69	30	1,020	25.0	84	27	1,026	23.8	85	17	1,012	26.2	91	31	992	17.0	59	31	1,012	14.2	80	31	1,015	16.3	72
500	31	954	11.7	69	30	964	21.2	89	27	969	20.5	86	17	957	24.5	81	31	952	14.3	61	31	958	11.8	82	31	959	13.2	78
1,000	31	899	8.1	72	30	910	18.5	84	27	915	18.2	83	17	904	21.8	81	31	897	10.3	64	30	903	8.4	87	31	904	9.8	82
1,500	30	846	4.4	78	30	858	15.9	79	27	863	16.0	77	17	853	18.8	79	31	844	6.6	69	30	850	5.1	92	31	851	7.2	81
2,000	29	796	1.1	84	30	809	13.7	73	27	813	14.2	66	17	804	16.0	67	31	794	3.1	75	28	799	2.3	92	31	800	4.7	75
2,500	28	747	−1.7	85	30	762	11.0	64	27	766	11.7	61	16	758	14.0	47	31	746	−.4	79	28	750	.7	83	30	752	2.5	67
3,000	26	702	−4.2	82	26	718	8.2	61	27	721	8.8	61	14	715	11.5	40	31	701	−3.6	81	26	705	−1.7	76	30	707	.3	63
4,000	26	617	−9.5	77	25	636	2.7	57	25	639	3.0	59	9	633	4.0	56	31	617	−9.6	75	20	621	−7.0	64	29	624	−5.1	58
5,000	26	542	−15.6	71	26	561	−2.7	55	25	564	−2.9	58					31	541	−15.7	65	18	545	−13.1	60	28	548	−11.2	54
6,000	26	474	−21.9	67	25	494	−8.3	50	25	496	−8.7	54					31	473	−22.7	61	17	477	−19.8	57	26	481	−17.9	51
7,000	26	412	−29.1	65	22	434	−14.4	50	25	436	−15.0	48					30	412	−29.7	57	14	416	−26.9	53	26	420	−24.7	48
8,000	27	358	−36.2	61	22	380	−21.2	48	25	381	−21.9	46					30	358	−36.7	55	14	361	−34.8	52	25	365	−32.2	47
9,000	28	309	−43.0		20	330	−28.3	46	25	332	−29.4	45					30	309	−43.5		12	312	−41.1		24	316	−39.3	47
10,000	28	266	−47.7		20	287	−35.8	45	25	288	−37.4	45					30	266	−48.5		12	270	−47.1		23	273	−45.2	
11,000	28	229	−48.0		20	248	−43.8		25	248	−45.8						30	229	−49.0		10	232	−50.9		23	234	−50.2	
12,000	28	197	−46.3		20	213	−51.5		25	213	−53.4						29	196	−45.9		10	199	−48.4		23	201	−51.5	
13,000	28	169	−44.5		20	182	−58.6		25	182	−59.0						29	169	−44.6		10	171	−46.1		22	172	−49.9	
14,000	27	146	−44.3		20	154	−63.0		21	155	−61.9						29	145	−44.2		10	147	−45.8		20	147	−49.4	
15,000	27	125	−44.5		20	131	−65.7		21	132	−62.4						29	125	−44.6		10	126	−45.7		19	126	−48.8	
16,000	27	108	−44.3		20	111	−66.8		21	112	−62.7						28	108	−44.7		8	109	−45.1		17	108	−48.8	
17,000	27	93	−44.4		19	94	−65.3		19	96	−61.9						27	93	−44.6		6	94	−45.1		14	92	−48.3	
18,000	26	80	−44.5		19	79	−62.3		16	81	−59.9						26	80	−44.5		5	81	−45.1		11	79	−48.1	
19,000	23	69	−44.6		17	67	−59.6		8	69	−57.9						22	69	−44.3									
20,000	22	59	−44.7		7	57	−57.0										16	59	−44.2									
21,000	15	51	−44.7														7	51	−43.8									
22,000	8	44	−44.9																									

See footnotes at end of table.

TABLE 1.—*Mean free-air barometric pressure in millibars, temperature in degrees Centigrade, and relative humidities in percent, obtained by airplanes and radiosondes during July 1941*—Continued

Altitude (meters) m. s. l.	Stations with elevations in meters above sea level—															
	Nome, Alaska (14 m.)				Pearl Harbor, T. H. (7 m.)[1]				St. Thomas, V. I. (8 m.)[1 2]				San Juan, P. R. (15 m.)			
	Number of observations	Pressure	Temperature	Relative humidity	Number of observations	Pressure	Temperature	Relative humidity	Number of observations	Pressure	Temperature	Relative humidity	Number of observations	Pressure	Temperature	Relative humidity
Surface	30	1008	10.8	82	31	1016	24.2	76	31	1018	27.5	74	31	1016	25.4	89
500	30	951	8.4	82	31	960	20.6	80	31	963	23.3	91	31	962	23.7	87
1,000	30	896	6.5	79	31	906	17.4	84	31	908	20.1	81	31	908	20.6	84
1,500	30	842	4.1	76	31	854	15.0	77	31	858	16.8	76	31	858	17.6	80
2,000	30	792	1.6	76	31	805	14.2	54	31	809	14.8	68	31	808	14.9	71
2,500	30	744	−.8	74	31	758	12.4	38	31	763	12.7	61	31	761	12.4	61
3,000	30	698	−3.2	67	31	714	10.0	33	31	719	9.8	57	31	718	9.5	55
4,000	29	615	−8.9	58	31	632	4.3	25	31	637	4.7	47	31	636	4.4	49
5,000	29	540	−15.1	52	31	559	1.0	20					31	562	−.9	44
6,000	29	472	−21.9	50	29	492	−5.2	20					31	495	−6.8	40
7,000	29	411	−28.9	49	29	432	−11.6	18					31	435	−13.7	38
8,000	28	357	−36.2	48	16	378	−18.6						30	381	−20.0	37
9,000	28	308	−42.9		15	329	−26.1						30	331	−27.5	36
10,000	25	266	−47.3		14	286	−33.5						30	288	−35.4	35
11,000	23	228	−48.8		14	247	−41.0						30	249	−43.7	
12,000	22	196	−45.9		13	213	−48.8						30	214	−51.7	
13,000	22	169	−44.2		12	182	−55.6						30	182	−59.4	
14,000	20	145	−44.1		11	155	−61.6						30	155	−65.6	
15,000	20	125	−44.0		7	132	−65.6						30	131	−69.2	
16,000	20	108	−43.9		7	112	−67.9						30	111	−71.7	
17,000	18	93	−43.9		5	94	−67.5						29	94	−72.3	
18,000	16	80	−43.8										27	79	−69.6	
19,000	13	69	−43.8										24	67	−66.2	
20,000	13	59	−43.7										16	57	−63.0	
21,000	7	51	−43.4										10	48	−60.8	
22,000													5	41	−58.8	

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Altitude (meters) m. s. l.	San Juan, P. R. (15 m.)				Altitude (meters) m. s. l.	San Juan, P. R. (15 m.)				Altitude (meters) m. s. l.	San Juan, P. R. (15 m.)				Altitude (meters) m. s. l.	San Juan, P. R. (15 m.)			
	Number of observations	Pressure	Temperature	Relative humidity		Number of observations	Pressure	Temperature	Relative humidity		Number of observations	Pressure	Temperature	Relative humidity		Number of observations	Pressure	Temperature	Relative humidity
Surface	29	1,016	25.5	87	3,000	28	717	10.3	53	9,000	27	331	−28.4	44	15,000	18	131	−73.6	
500	29	961	23.6	88	4,000	28	636	4.2	50	10,000	26	288	−36.2	43	16,000	18	110	−75.1	
1,000	29	908	20.8	86	5,000	28	562	−1.8	50	11,000	25	248	−44.4		17,000	17	93	−74.5	
1,500	29	857	17.9	82	6,000	28	495	−7.8	49	12,000	23	213	−52.5		18,000	13	78	−69.8	
2,000	29	808	15.3	70	7,000	28	434	−14.2	47	13,000	20	182	−60.3		19,000	8	66	−64.7	
2,500	29	762	13.1	58	8,000	27	380	−21.3	46	14,000	18	155	−67.7						

[1] U. S. Navy.
[2] Airplane observations.
[3] Observations made on Coast Guard vessels in or near the 5° square: Lat. 35°00′ N. to 40°00′ N.; long. 55°00′ W. to 60°00′ W.
[4] Observations made on Coast Guard vessels in or near the 5° square: Lat. 35°00′ N. to 40°00′ N.; long. 45°00′ W. to 50°00′ W.

NOTE.—All observations taken at 12:30 a. m. 75th meridian time, except at Lakehurst, N. J., where they are taken near 5 a. m.; E. S. T.; at Norfolk, Va., where they are taken at about 6 a. m.; and at Pearl Harbor, T. H., at 7 a. m.

None of the means included in this table are based on less than 15 surface or 5 standard level observations.

Number of observations refers to pressure only as temperature and humidity data are missing for some observations at certain levels; also, the humidity data are not used in daily observations when the temperature is below −40.0° C.

TABLE 2.—*Free-air resultant winds based on pilot balloon observations made near 5 p. m. (75th meridian time) during July 1941. Directions given in degrees from North (N=360°, E=90°, S=180°, W=270°)—velocities in meters per second*

Altitude (meters) m. s. l.	Abilene, Tex. (537 m.)			Albuquerque, N. Mex. (1,630 m.)			Atlanta, Ga. (299 m.)			Billings, Mont. (1,095 m.)			Bismarck, N. Dak. (512 m.)			Boise, Idaho (866 m.)		
	Observations	Direction	Velocity	Observations	Direction	Velocity	Observations	Direction	Velocity	Observations	Direction	Velocity	Observations	Direction	Velocity	Observations	Direction	Velocity
Surface	31	134	1.7	31	227	1.3	30	196	2.0	31	312	0.6	31	249	1.4	31	316	4.3
500							30	217	2.8									
1,000	31	147	3.2				30	234	3.3				31	296	.9	31	315	3.9
1,500	31	153	2.3				29	238	2.9	31	322	1.0	30	288	1.7	31	318	3.0
2,000	31	152	1.1	31	225	1.2	27	260	2.2	30	304	1.4	29	281	3.2	31	277	1.5
2,500	30	227	.7	31	246	1.1	24	265	2.1	30	274	2.4	27	274	4.0	31	249	2.8
3,000	29	244	.9	31	287	1.7	23	274	2.3	30	267	4.1	25	271	5.7	31	243	4.0
4,000	27	309	2.2	29	317	2.6	19	268	2.2	24	268	6.4	22	279	7.9	31	247	6.8
5,000	24	309	2.5	27	308	2.8	15	294	3.1	20	273	8.7	20	276	9.0	29	241	8.4
6,000	22	342	2.2	27	289	3.4	14	306	2.8	19	274	10.1	20	280	11.2	29	243	8.8
8,000	17	325	.9	23	264	6.2	11	190	.6	11	279	8.8	18	273	13.9	18	261	11.0
10,000	16	354	3.3	20	267	10.1							15	273	17.4			
12,000	13	3	4.6	15	264	13.8							11	280	19.3			
14,000	11	339	6.7	13	262	13.9												

Altitude (meters) m. s. l.	Brownsville, Tex. (7 m.)			Buffalo, N. Y. (220 m.)			Burlington, Vt. (132 m.)			Charleston, S. C. (18 m.)			Chicago, Ill. (192 m.)			Cincinnati, Ohio (152 m.)			Denver, Colo. (1,627 m.)		
	Observations	Direction	Velocity	Observations	Direction	Velocity	Observations	Direction	Velocity	Observations	Direction	Velocity	Observations	Direction	Velocity	Observations	Direction	Velocity	Observations	Direction	Velocity
Surface	31	145	6.1	31	265	3.2	31	208	1.3	31	174	2.5	31	316	0.9	30	246	0.7	31	23	1.5
500	31	149	7.2	31	260	3.5	31	205	2.6	31	191	5.7	31	343	1.1	30	249	1.8			
1,000	30	160	6.2	29	263	4.0	30	238	2.7	30	201	5.4	31	287	2.4	30	253	2.6			
1,500	29	167	5.1	29	261	4.4	30	270	4.2	27	211	4.7	30	274	4.0	29	261	3.0			
2,000	24	168	4.2	26	276	5.2	26	275	4.8	26	213	3.3	29	274	4.6	29	278	3.8	31	43	2.6
2,500	23	161	3.2	25	278	5.7	25	283	5.7	24	230	3.3	28	285	5.8	28	289	4.0	31	42	2.4
3,000	21	161	3.3	24	279	7.1	20	274	6.4	23	235	3.0	26	294	6.1	27	294	4.6	31	19	2.1
4,000	17	156	3.2	17	300	8.8	16	285	7.1	22	230	3.1	25	295	7.9	23	284	5.5	30	323	3.1
5,000	16	166	2.9	13	295	8.9				16	255	1.0	21	291	10.0	21	288	7.3	25	304	4.0
6,000	16	167	2.2	12	304	9.2				13	64	.7	20	286	11.9	19	291	8.6	19	285	5.3
8,000	12	114	1.6										15	287	15.4	13	280	9.8	13	294	3.6
10,000																			11	256	5.0
12,000																			11	286	7.6
14,000																					

TABLE 2.—*Free-air resultant winds based on pilot balloon observations made near 5 p. m. (74th meridian time) during July 1941. Directions given in degrees from North (N=360°, E=90°, S=180°, W=270°) —velocities in meters per second*—Continued

Altitude (meters) m. s. l.	El Paso, Tex. (1,196 m.)			Ely, Nev. (1,910 m.)			Grand Junction, Colo. (1,413 m.)			Greensboro, N. C. (271 m.)			Havre, Mont. (767 m.)		
	Observations	Direction	Velocity	Observations	Direction	Velocity	Observations	Direction	Velocity	Observations	Direction	Velocity	Observations	Direction	Velocity
Surface	31	111	2.3	31	195	2.5	31	325	1.9	31	205	1.5	31	255	1.9
500										31	209	2.6			
1,000										31	219	3.5	31	271	2.4
1,500	31	124	2.2				31	325	2.6	29	245	3.2	31	265	2.0
2,000	31	152	1.3	31	196	2.8	31	319	2.9	25	260	4.2	31	277	2.3
2,500	31	105	.5	31	201	3.1	31	297	2.7	24	271	5.0	28	270	3.7
3,000	30	70	1.2	31	211	3.5	31	266	2.7	21	271	4.8	25	272	5.0
4,000	31	9	1.6	31	217	4.3	30	257	3.1	19	283	5.6	19	272	5.8
5,000	21	345	3.5	29	236	6.5	30	252	3.4	16	280	4.5	16	276	7.6
6,000	14	290	2.0	24	236	7.6	24	252	2.9	14	285	6.4			
8,000				18	241	9.2	15	244	4.2						
10,000				13	240	12.4									
12,000				13	238	16.4									
14,000				10	237	18.6									
16,000															
18,000															

Altitude (meters) m. s. l.	Jacksonville, Fla. (14 m.)			Las Vegas, Nev. (570 m.)			Little Rock, Ark. (79 m.)			Medford, Oreg. (410 m.)		
	Observations	Direction	Velocity	Observations	Direction	Velocity	Observations	Direction	Velocity	Observations	Direction	Velocity
Surface	30	159	2.8	31	149	1.9	30	185	0.7	31	296	1.5
500	30	189	3.7				30	239	.7	31	306	2.1
1,000	30	209	4.7	31	163	2.7	28	261	1.6	31	311	1.8
1,500	28	216	4.9	31	187	2.7	28	275	2.2	31	290	1.3
2,000	27	229	4.5	30	196	3.7	27	275	2.5	30	236	1.8
2,500	25	228	4.8	30	204	4.2	26	288	2.4	30	213	3.4
3,000	23	234	4.9	30	212	4.6	25	305	3.1	30	213	4.4
4,000	17	213	4.0	29	223	5.4	25	321	4.0	30	223	4.8
5,000	15	221	2.4	27	224	4.8	21	306	4.1	29	236	6.1
6,000	13	221	2.1	26	233	5.4	19	292	3.6	27	241	7.5
8,000				22	256	6.6	12	250	4.9	24	238	10.0
10,000				22	251	11.2				21	244	12.3
12,000				20	252	16.2				17	245	12.0
14,000				18	250	17.8				13	259	12.9
16,000				15	249	4.4						
18,000				10	173	1.9						

Altitude (meters) m. s. l.	Miami, Fla. (10 m.)			Minneapolis, Minn. (265 m.)			Mobile, Ala. (8 m.)			Nashville, Tenn. (194 m.)		
	Observations	Direction	Velocity	Observations	Direction	Velocity	Observations	Direction	Velocity	Observations	Direction	Velocity
Surface	30	136	3.0	31	209	0.6	31	201	2.1	30	229	0.9
500	30	149	4.7	31	205	1.1	31	218	4.4	30	201	1.4
1,000	30	158	3.8	31	234	1.5	29	248	3.0	30	247	1.6
1,500	29	154	1.8	28	244	2.6	27	269	1.6	30	271	1.5
2,000	28	139	1.5	25	264	3.2	23	310	1.7	29	280	2.3
2,500	27	176	1.0	19	286	4.7	23	324	2.4	27	285	2.8
3,000	27	170	1.0	17	297	5.6	19	311	3.7	25	294	2.6
4,000	23	180	1.7	11	300	4.6	18	282	3.0	17	295	4.3
5,000	18	163	1.6				14	274	3.7	12	274	3.3
6,000	17	164	1.4									
8,000	11	110	2.9									
10,000	12	81	5.5									
12,000	10	72	10.6									
14,000												
16,000												
18,000												

Altitude (meters) m. s. l.	New York, N. Y. (15 m.)			Oakland, Calif. (8 m.)			Oklahoma City, Okla. (402 m.)			Omaha, Nebr. (306 m.)			Phoenix, Ariz. (338 m.)		
	Observations	Direction	Velocity	Observations	Direction	Velocity	Observations	Direction	Velocity	Observations	Direction	Velocity	Observations	Direction	Velocity
Surface	30	177	3.0	31	283	4.9	31	174	2.2	31	143	1.5	31	269	1.4
500	30	229	3.7	31	260	3.5	31	170	2.6	31	138	2.0	31	270	1.5
1,000	29	261	4.8	30	220	3.0	31	173	2.7	31	167	1.2	31	273	2.1
1,500	27	277	5.0	29	196	2.9	31	190	2.5	31	229	.8	31	244	2.2
2,000	21	281	5.8	29	192	3.2	30	214	1.4	31	297	2.5	30	248	2.5
2,500	14	292	5.6	29	184	3.4	30	263	1.2	29	294	5.6	30	238	2.2
3,000	12	294	5.0	29	177	3.2	28	310	1.7	29	297	6.8	30	246	2.2
4,000	12	307	6.7	29	192	3.5	25	315	2.9	26	301	8.6	30	239	2.7
5,000				29	204	3.5	23	303	2.9	23	305	8.2	27	240	1.6
6,000				29	217	3.6	22	297	3.5	21	305	9.3	27	254	2.8
8,000				29	224	6.3	18	239	2.9	19	298	8.7	23	265	4.3
10,000				29	228	10.1	10	269	3.4	13	289	10.0	22	275	9.6
12,000				27	239	12.4							21	261	13.3
14,000				20	255	12.0							15	264	15.1
16,000				15	233	8.0							10	242	10.6

Altitude (meters) m. s. l.	Rapid City, S. Dak. (982 m.)			St. Louis, Mo. (181 m.)			San Antonio, Tex. (180 m.)			San Diego, Calif. (15 m.)		
	Observations	Direction	Velocity	Observations	Direction	Velocity	Observations	Direction	Velocity	Observations	Direction	Velocity
Surface	30	16	2.0	31	351	0.7	31	122	3.1	30	293	4.6
500				31	340	1.3	31	127	4.0	30	302	2.6
1,000	30	21	2.0	30	303	1.5	31	144	3.6	28	271	1.3
1,500	30	32	1.0	30	292	2.0	31	138	3.3	28	259	1.6
2,000	30	302	.6	28	290	3.5	30	145	2.4	27	250	1.7
2,500	30	274	2.7	28	287	4.9	26	172	2.0	27	218	3.2
3,000	27	279	5.2	24	294	6.6	20	179	1.5	27	219	3.7
4,000	27	279	7.0	22	296	7.1	15	288	1.3	25	203	4.5
5,000	24	285	7.9	19	297	7.1	13	250	.7	22	200	5.4
6,000	20	282	8.0	16	293	9.1	10	274	1.8	14	204	2.7
8,000	15	264	8.6	12	292	10.4						
10,000	11	278	8.5									
12,000												
14,000												
16,000												

Altitude (meters) m. s. l.	Sault Ste. Marie, Mich. (230 m.)			Seattle Wash. (14 m.)			Spokane, Wash. (603 m.)			Washington, D. C. (24 m.)		
	Observations	Direction	Velocity	Observations	Direction	Velocity	Observations	Direction	Velocity	Observations	Direction	Velocity
Surface	28	285	3.1	31	298	2.2	31	217	1.7	29	177	2.6
500	28	291	4.7	31	309	1.4				29	210	2.6
1,000	28	292	4.7	30	295	1.4	31	222	1.8	26	250	2.9
1,500	28	294	4.5	30	286	1.6	31	227	1.9	21	271	5.5
2,000	28	294	4.9	28	247	1.4	31	227	2.6	19	283	7.2
2,500	25	304	5.3	27	225	2.2	31	224	3.4	17	289	7.1
3,000	21	314	7.4	27	223	2.8	31	230	4.2	12	290	9.5
4,000	18	317	8.4	26	227	4.5	28	248	7.2	11	294	11.8
5,000	16	319	10.6	24	234	5.5	26	252	9.0			
6,000	11	319	10.9	22	239	6.9	24	253	10.1			
8,000				14	260	6.9	21	241	12.2			
10,000							17	243	14.4			
12,000							13	233	11.3			
14,000												
16,000												

TABLE 3.—*Maximum free-air wind velocities (m. p. s.), for different sections of the United States based on pilot-balloon observations during July 1941*

Section	Surface to 2,500 meters (m. s. l.)					Between 2,500 and 5,000 meters (m. s. l.)					Above 5,000 meters (m. s. l.)				
	Maximum velocity	Direction	Altitude (m) m. s. l.	Date	Station	Maximum velocity	Direction	Altitude (m) m. s. l.	Date	Station	Maximum velocity	Direction	Altitude (m) m. s. l.	Date	Station
Northeast [1]	30.2	NW	2,260	28	Philadelphia, Pa.	38.1	WNW	5,000	3	Caribou, Maine	56.0	SW	9,460	21	Boston, Mass.
East-Central [2]	27.9	WSW	950	30	Cincinnati, Ohio	29.8	SSW	2,810	9	Chattanooga, Tenn.	40.8	W	12,640	15	Louisville, Ky.
Southeast [3]	21.2	SW	1,960	4	Spartanburg, S. C.	18.0	SW	2,500	4	Spartanburg, S. C.	30.1	SW	13,670	17	Atlanta, Ga.
North-Central [4]	27.5	S	1,000	20	Huron, S. Dak.	35.2	SSW	4,380	26	Bismarck, N. Dak.	54.4	NW	9,290	17	Fargo, N. Dak.
Central [5]	29.3	S	1,650	20	North Platte, Nebr.	68.0	SW	4,170	2	Evansville, Ind.	43.6	W	12,380	14	Chicago, Ill.
South-Central [6]	28.5	SSE	1,770	27	Big Spring, Tex.	18.4	NE	4,110	11	Big Spring, Tex.	28.4	NW	12,870	18	Waco, Tex.
Northwest [7]	26.6	NW	1,100	21	Ellensburg, Wash.	35.9	WSW	3,380	22	Great Falls, Mont.	49.6	W	11,450	8	Portland, Oreg.
West-Central [8]	43.0	SSE	2,290	11	Cheyenne, Wyo.	28.4	S	4,700	6	Ely, Nev.	48.8	WSW	12,000	31	Winnemucca, Nev.
Southwest [9]	21.4	E	1,850	13	Albuquerque, N. Mex.	25.5	ESE	3,030	15	Tucson, Ariz.	44.4	W	15,430	4	Las Vegas, Nev.

[1] Maine, Vermont, New Hampshire, Massachusetts, Rhode Island, Connecticut, New York, New Jersey, Pennsylvania, and northern Ohio.
[2] Delaware, Maryland, Virginia, West Virginia, southern Ohio, Kentucky, eastern Tennessee, and North Carolina.
[3] South Carolina, Georgia, Florida, and Alabama.
[4] Michigan, Wisconsin, Minnesota, North Dakota, and South Dakota.
[5] Indiana, Illinois, Iowa, Nebraska, Kansas, and Missouri.
[6] Mississippi, Arkansas, Louisiana, Oklahoma, Texas (except extreme west Texas), and western Tennessee.
[7] Montana, Idaho, Washington, and Oregon.
[8] Wyoming, Colorado, Utah, Northern Nevada, and northern California.
[9] Southern California, southern Nevada, Arizona, New Mexico, and extreme west Texas.

WEATHER ON THE NORTH ATLANTIC OCEAN

By H. C. HUNTER

Atmospheric pressure.—July 1941 had no remarkable features in the matter of pressure. As far as available reports show the averages were everywhere close to normal. There was a slight tendency over many parts of the ocean for pressure to be above normal during the first 10 days of the month, but below normal during the final week.

The extremes of pressure found in the vessel reports at hand were 1,035.9 and 982.1 millibars (30.59 and 29.00 inches). The high mark was recorded near 39° N., 46° W., during the evening of the 13th, and the low near 58° N., 50° W., about mid-forenoon of the 4th.

TABLE 1.—*Averages, departures, and extremes of atmospheric pressure (sea level) at selected stations for the North Atlantic Ocean and its shores, July 1941*

Station	Average pressure	Departure from normal	Highest	Date	Lowest	Date
	Millibars	*Millibars*	*Millibars*		*Millibars*	
Lisbon, Portugal [1]	1,016.5	−0.1	1,022	16	1,012	10, 11
Horta	1,025.7	+.6	1,033	8	1,016	21
Belle Isle, Newfoundland [2]			1,019	27	987	3
Halifax, Nova Scotia	1,015.1	+.9	1,026	6	1,006	30
Nantucket	1,014.9	−.3	1,024	6	1,003	29
Hatteras	1,016.3	0	1,023	6	1,008	31
Turks Island	1,018.7	+.4	1,020	[3] 2	1,017	[3] 24
Key West	1,016.9	0	1,021	2	1,014	25
New Orleans	1,015.6	−.3	1,022	21	1,010	5

[1] For 27 days.
[2] For 18 days.
[3] Also on subsequent dates.

NOTE.—All data based on available observations, departures compiled from best available normals related to times of observation, except Hatteras, Key West, Nantucket, and New Orleans, which are 24-hour corrected means.

Cyclones and gales.—The month included scarcely any storm activity that has come to notice. However, the first week and the final week were not quite so quiet as the remainder of the month. About the 4th and again during the final 3 days some stormy weather was met to northeastward of Newfoundland, one vessel noting force 11 during the 30th.

In the Caribbean area there were intensified trade winds of force 6 or force 7 at various times, as the accompanying table of Ocean Gales shows.

No true cyclonic disturbance of tropical origin was reported from any Atlantic area during the month.

Fog.—Three of the 5° squares were notable for occurrences of fog. Leading all other North Atlantic areas for this month, by the reports at hand, was the square including the coasts of southern New England, Long Island, and northeastern New Jersey, 40° to 45° N., 70° to 75° W.; 12 days had fog in this area. The other two squares, in each of which fog was seen on 11 days, adjoin the first-named; one is situated to southward, 35° to 40° N., 70° to 75° W.; the other is to eastward, 40° to 45° N., 65° to 70° W.

In the first- and second-named squares there was comparatively little fog during the final fortnight of the month; whereas in the third-named square it was the opening fortnight which included only a few occurrences of fog, the dates from 15th to 23d having most of the thick weather.

In the first-named square, fog was about as frequent as usual in July and showed some increase over the number of days with fog during June just preceding. In the second-named, fog occurred more often than during an average July, yet did not come up to the count of June just preceding. The third-named square, located chiefly to eastward of New England, is normally the very foggiest part of the whole North Atlantic in July, so that the count of 11 is hardly half the expected number of foggy days, though 11 is considerably greater than the occurrences of fog that had been reported there during the preceding June.

A very little fog was noted to southward of Cape Hatteras and east of the coast of the South Atlantic States in widely scattered localities; also a few occurrences were reported at considerable distances to northwestward of Bermuda.

From the waters comparatively near to Nova Scotia or to Newfoundland there have come a moderate number of fog reports, but no mention of fog over any part of the North Atlantic to eastward of the 45th meridian during this July has as yet been received.

OCEAN GALES AND STORMS, JULY 1941

Vessel [1]	Position at time of lowest barometer: Latitude	Position at time of lowest barometer: Longitude	Gale began	Time of lowest barometer	Gale ended	Lowest barometer	Direction of wind when gale began	Direction and force of wind at time of lowest barometer	Direction of wind when gale ended	Direction and highest force of wind	Shifts of wind near time of lowest barometer
NORTH ATLANTIC OCEAN	° ′	° ′				*Millibars*					
A vessel	[2] 12 10 N.	78 12 W.	2	4p, 2	4	1,010.8	NE	NE, 6	E	ESE, 7	NE-ENE.
Do	58 00 N.	49 36 W.	4	10a, 4	4	982.1		E, 9		E, 9	
Do	36 48 N.	65 12 W.	5	2a, 5	5	1,018.6		SW, 7		SW, 8	
Do	14 06 N.	78 12 W.	6	7a, 8	7	1,012.5	E	ENE, 4	E	E, 6	
Do	54 30 N.	54 18 W.	25	9a, 25	26	997.0	NW	Calm	NW	NW, 8	SE-WNW.
Do	10 36 N.	79 06 W.	27	7p, 28	29	1,009.8	NE	NE, 4	ENE	NE, 7	
Do	38 30 N.	58 48 W.	29	8p, 29	29	997.6		SW, 7		SSW, 8	SSW-W.
Do	56 30 N.	47 18 W.	29	3a, 31	30	995.6	ENE	E, 4	ESE	E, 11	
NORTH PACIFIC OCEAN											
A vessel	14 18 N.	129 54 E.	1	4p, 1	3	1,001.7	NNW	E, 9	SE	E, 10	
Do	18 10 N.	118 46 W.	3	11a, 3	3	995.9	N	WNW, 9	S	WNW, 9	NW-WSW.
Do	17 50 N.	118 56 W.	3	12m, 3	3	1,000.0	N	W, 9	W	W, 9	WNW-S.
Do	[2] 15 48 N.	109 42 W.	5	2a, 6	6	1,000.3	NNW	W, 8	SSW	W, 8	NW-SW.
Do	15 54 N.	109 12 W.	6	4a, 6	6	998.3	WNW	W, 9	S	W, 9	WNW-SW.
Do	41 48 N.	124 42 W.	8	10a, 8	8	1,013.2	NNW	NNW, 8	NNW	NNW, 8	
Do	[2] 39 03 N.	178 53 W.	14	8p, 13	14	1,008.1	W	WNW, 8	N	NW, 9	WNW-NW.
Do	42 18 N.	152 18 W.	14	12p, 14	15	997.5	SE	SSE, 8	SSW	S, 9	SE-S.
Do	14 42 N.	105 12 W.	15	4p, 15	16	994.6	NNW	WNW, 8	S	SSW, 10	NW-SW.
Do	14 00 N.	111 36 W.	16	6p, 16	17	1,005.8	SW	WSW, 6	SSW	SW, 8	WSW-SSW.
Do	22 24 N.	115 00 W.	17	2a, 18	18	1,007.1	NNE	E, 7	SE	E, 7	
Do	51 — N.	149 — W.	18	6a, 19	19	997.6	SE	ESE, 8	ESE	ESE, 8	ESE-SSE.
Do	12 54 N.	117 35 W.	21	4p, 21	22	999.3	N	N, 10	ESE	N, 10	N-ENE.
Do	35 18 N.	123 48 W.	22	4a, 25	24	1,013.5	NNE	NW, 5	NW	N, 9	
Do	24 24 N.	138 24 E.	23	12m, 24	25	997.3	E	S, 2	SE	SSE, 8	NE-S-SE.

[1] Beginning with this issue of the REVIEW, and continuing during the present emergency, publication of the names and itineraries of weather-reporting vessels will be discontinued.
[2] Position approximate.

WEATHER ON THE NORTH PACIFIC OCEAN

By WILLIS E. HURD

Atmospheric pressure.—Mean pressure was practically normal in July at nearly all points on the North Pacific shores. The most notable departure from normal occurred at St. Paul Island, in the Bering Sea, where the average pressure, 1,014.2 millibars (29.95 inches), was 3.7 millibars (0.11 inch) above the July normal. At the northern extremity of Alaska, the mean pressure at Barrow was 2.5 millibars (0.08 inch) below the normal.

The Aleutian LOW was considerably weaker in July than in the previous June, and lay as a shallow depressed area along the Aleutian Islands and the Peninsula of Alaska. The tendency, however, was for a general northward movement of the LOW into the Arctic Ocean, as indicated by the mean pressure at Barrow, which was 3½ millibars (0.10 inch) below that at St. Paul.

High pressure prevailed in midocean.

TABLE 1.—*Averages, departures, and extremes of atmospheric pressure (sea level) at selected stations for the North Pacific Ocean and its shores, July 1941*

Station	Average pressure	Departure from normal	Highest	Date	Lowest	Date
	Millibars	*Millibars*	*Millibars*		*Millibars*	
Barrow	1,010.7	−2.5	1,025	10	992	21
Dutch Harbor	1,013.9	+0.1	1,028	27	995	13
St. Paul	1,014.2	+3.7	1,030	27	995	14
Kodiak	(1)	(1)	(1)	(1)	(1)	(1)
Juneau	1,018.0	+0.4	1,027	9	1,005	20
Tatoosh Island	1,018.0	+0.2	1,026	29	1,010	27
San Francisco	1,013.9	−0.3	1,019	29	1,008	22
Mazatlan	1,011.4	+0.2	1,014	21	1,008	14
Honolulu	1,015.6	−1.0	1,019	1	1,012	31
Midway Island	1,020.6	+1.0	1,023	7, 8	1,016	25
Guam	1,008.9	−1.6	1,012	13	1,003	31
Manila [2]	1,007.9	+0.8	1,011	10	1,001	3
Hong Kong	1,003.4	−0.7	1,009	31	996	5
Naha	(1)	(1)	(1)	(1)	(1)	(1)
Titijima	(1)	(1)	(1)	(1)	(1)	(1)
Petropavlovsk	(3)	(3)	(3)	(3)	(3)	(3)

[1] Insufficient data.
[2] For 18 days.
[3] No data.

NOTE.—Data based on 1 daily observation only, except those for Juneau, Tatoosh Island, San Francisco, and Honolulu, which are based on 2 observations. Departures are computed from best available normals related to time of observations.

Extratropical cyclones and gales.—A few disturbances of no great energy crossed northern waters of the Pacific, and very few gales resulting from their activities were indicated in ships' reports. The period 14th to 18th was the only one in which locally fresh to strong gales occurred well out at sea. During this time gales of force 9 were reported near 39° N., 179° W., on the 14th, and near 42° N., 152° W., on the 15th. On the 18th a force-8 gale occurred near 51° N., 149° W. On the 16th a cyclone of some depth was centered near Kodiak Island.

Local gales of force 8 to 9 were experienced not far from the California coast on the 8th and 24th.

Tropical cyclones.—Subjoined is a report by the Reverend Bernard F. Doucette, S. J., Weather Bureau, Manila, P. I., on five typhoons and one depression which occurred in waters of the Far East during July.

Little is known of the actual wind intensity of these cyclones throughout their courses, but in the earliest, that of June 29–July 6, a vessel reported an east gale of force 10, on July 1, east of the Philippines. In the cyclone of July 23–29, a vessel reported a southeasterly gale of force 8, barometer 997.3 millibars (29.45 inches), on the 25th, near 24½° N., 138½° E.

West of Mexico, observations point to the existence of at least three, and perhaps four or five, tropical cyclones in July. The earliest came under specific observation on the 3d, with two vessels reporting westerly gales of force 9 near 18° N., 119° W., lowest barometer 995.9 millibars (29.41 inches). The course of the storm may have been toward the Mexican coast south of Cape Corrientes, for during the early morning of the 6th there were further reports of fresh to strong shifting gales and low barometer near 16° N., 109° to 110° W. Since, however, the same two vessels that left the storm area on the 3d ran into the succeeding storm area on the 6th, some 9° to the eastward, and without intervening disturbed conditions noted, it is quite probable that the two occurrences represent two distinct cyclonic formations of brief existence.

Heavily disturbed weather appeared on the 15th near 15° N., 105° W., where fresh northwesterly gales shifting to southwesterly winds of force 10 occurred, with barometer as low as 994.6 millibars (29.37 inches). On the 16th, near 14° N., 111° to 112° W., further southwesterly gales were encountered. There are thus indications that the cyclone of the 15th had some westerly movement. However, disturbed weather, with strong easterly winds, was experienced on the 18th at some distance west of Cape San Lucas. On the 21st, also, heavy north gales shifting to easterly, with considerable depression of the barometer were reported near 13° N., 117° to 118° W. The relationship between these several isolated storm conditions observed is confused.

Fog.—Fog is usually at its height on the northwestern Pacific in July. During the current month, owing to reduced ships' observations, a sharp lessening of fog occurrence is noticeable for the area southwest of the Aleutian Islands. Between 35° and 45° N., west of the 180th meridian, fog was reported on 1 to 3 days in most of the 5° areas. In the eastern part of the Bering Sea fog was noted on 4 days, and in the Gulf of Alaska on 9 days. In the general area 32° to 45° N., 130° to 145° W., fog was observed on 9 days. Along the American coast 16 days were reported with fog in or near the Strait of Juan de Fuca. Ships noted fog on 3 days off Oregon, on 14 days off California, and on 6 days off Lower California. In the tropical ocean region 15° to 20° N., 112° to 118° W., there was fog on the 4th, 5th, and 9th.

TYPHOONS AND DEPRESSIONS OVER THE FAR EAST

BERNARD F. DOUCETTE, S. J.

[Weather Bureau, Manila, P. I.]

Typhoon, June 29–July 6, 1941.—When the preceding typhoon (June 23–July 4) was over the China Sea, a new typhoon began to manifest itself about 350 miles south of Guam, appearing as a depression. It moved northwest, then west, and intensified to typhoon strength during the afternoon hours of July 1 when the center was about 400 miles east of San Bernardino Strait. It became a threat to central and northern Luzon, but did not affect Catanduanes Island as the previous typhoon did. Moving west-northwest and then northwest, it crossed northern Luzon July 3 and 4, passing north of Palanan, Isabela Pr., south of Aparri and north of Tuguegarao, both in Cagayan Pr., and then north of Laoag, Ilocos Norte Pr., as it passed into the China Sea. This course is almost the same as that followed by the typhoon of June 23–July 4. It moved along a west-northwesterly course over the China Sea, inclining to the northwest as it approached the Continent. After passing inland about 75 miles northeast of Hong Kong it disappeared, July 6, over the regions north of the colony. The storm was not as intense as the previous typhoon and the reports of destruction printed in the newspapers were not startling. The writer did not read of any loss of life due to this storm.

Barometric minima reported from stations along the course of this typhoon are given below. Palanan, Isabela Pr., had 731.58 mm. (975.4 mb.) as its lowest pressure, July 3, 3 p. m. (Manila time). Tuguegarao, Cagayan Pr., reported 736.60 mm. (982.1 mb.) which occurred at 7:45 p. m. July 3. Aparri, Cagayan Pr., recorded 740.65 mm. (987.5 mb.) at 10:10 p. m. the same day. Early the next morning, Laoag, Ilocos Norte Pr., had its minimum value, 743.34 mm. (991.0 mb.) at 2:00 a. m. The highest wind velocities reported were force 9, from the south, at Palanan, after the center had passed. (Note.—Pressure values given above are corrected for gravity.)

Over the Philippines, the strongest velocity reported from the pilot-balloon stations was 110 k. p. h. at 2,000 meters over Cebu, July 3, afternoon ascent. The direction was southwest. At the other stations, the velocities at some levels were as high as 65 to 70 k. p. h. but mostly they were below 50 k. p. h., and in general, the upper winds were not so strong as during the preceding typhoon. The few reports received from Thailand and Indo-China stations indicated that the southwesterly air stream over these regions was weaker than during the 10-day period before July 1. At Guam, June 29, there were no ascents due to poor weather conditions and the easterly winds over that station reached velocities of 64 k. p. h. at 1,000 meters, June 30, 0300 G. C. T. ascent. This was the only time at Guam when velocities over 50 k. p. h. occurred during these few days when the disturbance was forming.

Typhoon, July 9–16, 1941.—A weak disturbance moved westward in a low-pressure area far to the east of northern Luzon. It became a definite depression on July 11, central about 500 miles east-northeast of San Bernardino Strait. After moving in a north-northwesterly direction about 800 miles, it intensified to typhoon strength over the regions about 450 miles east of Formosa. It then moved northwest into the Eastern Sea, where it recurved to the northeast, a course which carried it north of Oshima, Nansei Islands, and over the ocean parallel to the coast line of Japan. It disappeared southeast of central Japan.

Typhoon, July 11–16, 1941.—This typhoon appeared about 250 miles northeast of Guam, quite strong, probably originating over the eastern Caroline Islands. It moved north-northwest, then northwest, and coalesced with the typhoon described above (July 9–16) over the regions south of Kobe, after which both disturbances weakened and disappeared.

Guam had been in a southwesterly current since July 6, the velocities being under 50 k. p. h. There were no ascents July 10, due to poor weather conditions. July 11 and the following days showed a strong southwesterly current over the island, with velocities up to 80 k. p. h. (500 meters, afternoon ascent July 11) and then gradually decreasing to values less than 50 k. p. h. a few days later.

Typhoon, July 17–24, 1941.—There was a low-pressure area far to the southeast of Guam, which strengthened into a depression, July 18, central about 200 miles east-southeast of the island. The disturbance moved northwesterly and manifested itself as a typhoon about 120 miles north of Guam, July 19. It moved westerly for a short distance, and then made a sharp turn to the north. It moved rapidly in this direction, passing about 180 miles west of the Bonins, and reached Japan, July 23. It moved a short distance overland, recurving to the northeast about 100 miles north-northeast of Tokyo. It disappeared over the ocean July 24.

The upper winds over Guam changed from an easterly current, July 16, to a northerly current, July 17 and 18, and finally southwesterly winds were flowing over the island. At no time were the velocities over 35 k. p. h.

Depression, July 17–21, 1941.—Over the ocean between the Philippines and the Mariana Islands, a weak center appeared July 17, and moved slowly west-northwest, becoming a depression, July 20, about 500 miles east of the Balintang Channel. On July 21, it inclined to the north and disappeared about 400 miles east of Formosa. Apparently it was mild and not dangerous.

Typhoon, July 23–29, 1941.—A low pressure area moved west-northwest from the ocean regions about 300 miles west of the Mariana Islands. When it was central about 600 miles east of the Balintang Channel, it quickly changed to a northerly course and also intensified to typhoon strength. It moved rapidly toward Japan and crossed the southern regions of that country on July 27. It recurved to the northeast and east over the Sea of Japan and on July 29 it was over the Pacific Ocean, weakening to depression strength. It probably disappeared July 30.

Note.—On July 9, a ship's report was received at the Observatory (broadcast from 8 Z W, Zi-ka-wei, Shanghai) which read as follows: "Ships 13 136 SW. 3 rain vis. 744 pressure" (latitude 13 N. longitude 136 E., winds SW., force 3, pressure 744 mm. (991.9 mb.)). This observation could not be neglected. There were no means of verifying these numbers in a short space of time, so typhoon warnings were distributed and the disturbance, whatever it was, was kept on the weather maps for 2 or 3 days. There were other ships reporting from the regions east of San Bernardino Strait, none of which gave any indication of the existence of any typhoon, and so, unless further information is received, it will be assumed that there was an error of some kind in the above mentioned report. If the report is correct, and there really was a small typhoon in that locality, the writer would appreciate confirmation of the above report so that the typhoons of July 1941 may be correctly enumerated.

RIVER STAGES AND FLOODS

By Bennett Swenson

During July 1941, precipitation was above normal in all States east of the Mississippi River, except Indiana, Illinois, Michigan, and Wisconsin. In Tennessee, the precipitation was the heaviest for this month in 59 years of record, the average for the State being more than one and one-half times the normal; Virginia, the Carolinas, Alabama, and Mississippi had about one and one-half times the normal precipitation.

West of the Mississippi River, precipitation was deficient in the Upper Mississippi, the Missouri, and most of the Arkansas River Basins, but was above normal elsewhere except in Oregon and Arizona.

The excess rainfall during July maintained river stages above normal in the Southeastern States and in the Tennessee River for the first time this year. Floods, mostly light to moderate, were confined generally to the Carolinas and portions of Georgia, Tennessee, and Kentucky in the East, and in Kansas, Oklahoma, and eastern Texas west of the Mississippi.

Atlantic slope drainage.—Frequent rains during the month in the Carolinas and portions of Georgia, heavy during the week beginning July 13, resulted in light to moderate floods in most of the streams in this area.

The Roanoke River reached flood stage in the lower portion on July 22 and crested at a stage of 10.3 feet on the 24th at Williamston, N. C. The Neuse River overflowed from July 14 to 23, crest stages of from 2 to 4 feet above flood stage being recorded from Smithfield, N. C., to Kinston, N. C.

Light to moderate overflows occurred throughout the Santee River Basin with overflows extending throughout the month at some points. The total losses have been estimated at about $80,000 of which $42,000 was due to suspension of business (mostly on the Santee-Cooper Reservoir project). In addition, losses to highways and bridges in the State of South Carolina as a whole, mostly from high water in small streams, were estimated at approximately $20,000 by the State highway department.

Light flooding also occurred in portions of the Savannah, Ogeechee, and Altamaha River Basins in Georgia during the month, but with no appreciable damage.

Missouri River Basin.—A slight overflow occurred in the Republican River in July with a crest stage of 11.2 feet (2.2 feet above flood stage) at Guide Rock, Nebr., on July 28. At Concordia, Kans., the river just reached flood stage (8 feet) on the 29th.

Ohio River Basin.—A flash flood occurred in the Licking River Valley in northeastern Kentucky, in Fleming and Rowan Counties, on July 18–19. Torrential rains fell in about 3 hours between 7 and 11 p. m., on the 18th, over an area of approximately 1,000 square miles, with amounts ranging from 3 to nearly 5 inches. From available reports, the greatest intensity of the storm was at Flemingsburg, Ky., where 4.81 inches of rain occurred; Farmers, Ky., reported 4.47 inches, and Hadleman, Ky., 3.14 inches.

According to the United States Engineer Office, Cincinnati, Ohio, no lives were reported lost and damage to property was confined to the town of Flemingsburg with an estimated loss of $25,000.

In the Cumberland River Basin, heavy rains on July 2–5 caused a decided rise but flood stage was exceeded in the main river only at Williamsburg, Ky. Among the tributary streams, severe flooding occurred in the Wolf and Obey Rivers with crop damage in Clay and Pickett Counties in Tennessee amounting to several hundred thousand dollars. Byrdstown, Tenn., in this area, recorded 10.55 inches within 72 hours and 8.05 inches in 24 hours. Flood stage was also exceeded in the New River, at New River, Tenn., on July 4, by 0.9 foot.

The Tennessee River which was at a low stage at the beginning of the month, rose to somewhat higher stages during the last 3 weeks, due to rather heavy rains over the upper watershed.

Arkansas River Basin.—A slight overflow occurred in the Little Arkansas River on July 2–3 to the north of Wichita, Kans., as the result of heavy rains on the 2d. A few low places were inundated but no property loss was reported. The Ninnescah River also flooded slightly in the vicinity of Peck, Kans., on July 3, but with no material damage.

High stages in the Canadian Rivers at the close of June, followed by rains in the upper watersheds during the first week in July, led to further flooding in the North Canadian at Woodward and Canton, Okla., on July 7 and 8, and at Yukon, Okla., where the river was in flood the entire month. In the Canadian River, flood stage was exceeded at Canadian, Tex., on July 6 and again on July 26, and at Union, Okla., on July 26 and 27.

Red River Basin.—Flooding again prevailed during a portion of the month in the Sulphur River. At Ringo Crossing, Tex., an estimated crest of 28.5 feet was reached on July 16, and a crest of 25.6 feet at Naples, Tex., on July 22.

West Gulf of Mexico drainage.—The Sabine River exceeded flood stage between June 30 and July 8 but resulted in no material damage.

The flood in the Trinity River which began early in June continued during much of July. This flood will be discussed in a later report.

Estimated flood losses and savings for July 1941

River and drainage	Tangible property	Matured crops	Prospective crops	Livestock and other movable property	Suspension of business	Total losses	Total savings
ATLANTIC SLOPE							
Neuse River	$3,450				$5,000	$8,450	
Santee River	8,500	$7,300	$17,800	$4,500	42,300	80,400	$55,000
MISSISSIPPI SYSTEM							
Upper Mississippi Basin							
Streams in Northeastern Iowa [1]	579,500	6,000	307,430	51,800	1,000	945,730	5,000
Ohio Basin							
Licking River [2]	25,000					25,000	
Arkansas Basin							
North Canadian River [3]	58,000	55,300	347,700	3,500	2,100	466,600	15,000
Canadian River [3]	69,000	34,500	49,500	2,500		155,500	7,000
Red Basin							
Sulphur River [3]	21,000	5,000	100,000	3,000	8,000	137,000	11,000
Red River [3]	85,000	38,500	207,000	4,100	12,500	347,100	46,000
WEST GULF OF MEXICO							
Trinity River [4]	59,680	192,860	532,700	19,700	93,670	898,610	366,670
Colorado River [4]			3,000			3,000	
Pecos River [5]	472,830	1,000	124,000	15,000	2,000	614,830	25,000
Rio Grande [5]	327,500		112,200	24,000	193,160	656,860	1,511,000

[1] Floods of May 1941.
[2] Furnished by U. S. Engineer Office.
[3] Floods of June 1941.
[4] June and July 1941.
[5] Floods of May and June, 1941 in New Mexico, in addition to figures published previously.

FLOOD-STAGE REPORT FOR JULY 1941

[All dates in July unless otherwise specified]

River and station	Flood stage	Above flood stages—dates: From—	Above flood stages—dates: To—	Crest: Stage	Crest: Date
ATLANTIC SLOPE DRAINAGE					
	Feet			*Feet*	
Roanoke: Williamston, N. C	10	22	26	10.3	24
Neuse:					
Neuse, N. C	14	14	14	14.5	14
Smithfield, N. C	13	14	18	16.5	16
Goldsboro, N. C	14	17	23	17.9	21
Kinston, N. C	14	20	26	15.8	23
Pee Dee: Mars Bluff Bridge, S. C	17	20	23	17.1	21-22
Saluda:					
Pelzer, S. C	6	6	7	6.0	6-7
		8	9	6.5	9
Chappells, S. C	13	16	17	15.0	17
Broad: Blairs, S. C	14	6	10	18.5	7
				19.0	9
		16	19	20.0	18
Catawba:					
Catawba, N. C	8	16	18	12.6	17
Catawba, S. C	11	7	8	15.7	8
		18	18	13.5	18
Wateree: Camden, S. C	23	8	10	28.3	9
		18	19	26.3	18
Santee:					
Rimini, S. C	12	8	(1)	17.9	14
				18.4	23
Ferguson, S. C	12	June 29	1	12.1	June 30
		8	(1)	[3] 16.0	25
Broad: Carlton, Ga	15	6	7	16.4	7
Savannah:					
Butler Creek, Ga	21	8	9	22.8	9
		18	19	21.9	18
Clyo, Ga	11	(2)	8	12.4	5-6
		13	(1)	16.3	17
				15.4	26
Ogeechee: Dover, Ga	7	24	28	7.5	26
Altamaha: Charlotte, Ga	12	20	20	12.0	20
		22	25	12.4	24
MISSISSIPPI SYSTEM					
Upper Mississippi Basin					
Mississippi: Louisiana, Mo	12	(4)	(4)	12.2	1
Missouri Basin					
Republican:					
Guide Rock, Nebr	9	28	29	11.2	28
Concordia, Kans	8	29	29	8.0	29
Ohio Basin					
New: New River, Tenn	18	4	4	18.9	4
Cumberland:					
Williamsburg, Ky	19	5	6	21.0	6
Celina, Tenn	28	5	9	34.5	7

See footnotes at end of table.

FLOOD-STAGE REPORT FOR JULY 1941—Continued

[All dates in July unless otherwise specified]

River and station	Flood stage	Above flood stages—dates		Crest	
		From—	To—	Stage	Date
MISSISSIPPI SYSTEM—con.					
Arkansas Basin					
North Canadian:	*Feet*			*Feet*	
Woodward, Okla	5	7	7	5.4	7
Canton, Okla	9	8	8	9.0	8
Yukon, Okla	8	(2)	(1)	10.5 13.0	2 9-10
Canadian:					
Canadian, Tex	5	6 26	6 26	6.0 7.0	6 26
Union, Okla	7	26	27	9.0	26
Red Basin					
Sulphur:					
Ringo Crossing, Tex.[3]	20	12	23	28.5	16
Naples, Tex	22	20	27	25.6	22
WEST GULF OF MEXICO DRAINAGE					
Sabine: Logansport, La	25	June 30	8	[6] 25.8	[6] 3
Trinity:					
Dallas, Tex	28	June 11 2	2 4	43.0 28.4	June 12 3
Trinidad, Tex	28	June 7	10	45.4	June 19
Long Lake, Tex	40	June 14	7	46.5	June 22
Liberty, Tex	24	June 11	24	26.8	11-12

[1] Continued into following month.
[2] Continued from preceding month.
[3] An estimated 1.0 to 1.5 feet of rise due to back water from dam (Santee-Cooper project).
[4] Occasionally above flood stage due to operations of Dam No. 24.
[5] Stages estimated.
[6] No report July 4-6; crest of flood probably about 26.1 on 5th.

FLOOD LOSSES AND SAVINGS FOR 1940

By BENNETT SWENSON

The monetary losses from floods during the year have been estimated at more than $40,000,000 and a total of 60 lives were lost. The savings as the result of the river and flood warning service is reported to have amounted to about 6½ million dollars. The average annual loss for the period 1924 to 1940, inclusive, is about $94,000,000 and the average annual savings nearly $15,000,000. The losses and savings during the year 1940 are itemized by individual river basins in the table below.

The outstanding floods of 1940 were the floods of August in the rivers in southern Virginia, the Carolinas, and eastern Tennessee which resulted from heavy rains accompanying the passage inland of a tropical disturbance. The total losses from these floods have been estimated at about $12,000,000 and 40 lives.

Another tropical disturbance which moved inland over southwestern Louisiana and eastern Texas during August was responsible for severe flooding in that area, with damages amounting to about $6,000,000, mostly to growing crops.

Other important floods occurred in the Sacramento River in February and March with losses estimated at about $8,000,000, and in the small streams of northeastern Nebraska during June where damages amounted to nearly $2,000,000 and five lives were lost.

Estimated flood losses and savings for 1940

River and drainage	Tangible property	Matured crops	Prospective crops	Livestock and other movable farm property	Suspension of business	Total	Lives lost	Reported savings as the result of warnings
ST. LAWRENCE								
Red Cedar River							2	
ATLANTIC SLOPE								
Connecticut River			$50,000		$12,500	$62,500		$22,000
Rivers in southwest New Jersey	$1,000,000					1,000,000	4	
Schuylkill River		$50	50	$100		200		1,250
Susquehanna River	1,279,000		24,375	27,000	126,000	1,456,375		313,500
James River	24,300	5,000	50,000	2,600	9,625	91,525		190,800
Roanoke River	1,045,500	980,000	306,000	202,000	380,000	2,913,500	[1] 4	891,500
Tar River	50,000	10,000	150,000	4,500	10,000	224,500		20,000
Neuse River	10,000	6,000	6,000	2,400	3,000	27,400		15,000
Pee Dee River [2]	3,200					3,200	[1] 4	10,000
Santee River	171,000	58,000	8,200	2,200	33,900	273,300	[1] 1	92,700
Savannah River	1,452,000	20,000		8,000	20,500	1,500,500	3	2,000,000
EAST GULF OF MEXICO								
Apalachicola River				350	6,800	7,150		4,500
Choctowhatchee River	15,000	3,540	300	1,100	6,000	25,940		3,000
Black Warrior-Tombigbee River	206,050		4,685,750	2,000	38,200	4,932,000		99,600
Pearl and Pascagoula Rivers	131,218	80,100	240,500	16,325	63,250	531,393		91,800
MISSISSIPPI SYSTEM								
Upper Mississippi Basin								
Zumbro River (Minn.)			5,000			5,000		
Wisconsin River	5,740	4,280	13,460		13,360	36,840		44,050
Yellow, Volga, and Turkey Rivers in northeast Iowa	83,570	27,300	40,250	3,855	2,500	157,475		
Missouri Basin								
Rivers in Montana	2,700					2,700		
Streams in northeast Nebraska	500,000	100,000	1,000,000	100,000	13,000	1,713,000	5	30,000
Floyd River	12,000					12,000		
Kansas River	13,650		17,500			31,150		
Ohio Basin								
Allegheny River	[3] 201,300					201,300		17,000
Monongahela River	700					700		10,000
Scioto River	26,000		16,500			42,500		
New-Kanawha River	1,660,500	[4] 1,195,000				[5] 2,855,500	[1] 9	
Green River	2,350		17,800		15,000	35,150		33,000
East Fork of White River	26,600	38,000	77,500	1,000	4,100	147,200		52,000
West Fork of White River	1,000		10,700		3,250	14,950		9,100
White River (Ind.)	500		22,000		15,000	37,500		4,500
Wabash River	15,500	450	15,000		2,600	33,550		26,000
Watauga River	[6] 1,102,800		[6] 82,200		100,000	1,285,000	[1] 13	5,000
Holston River	[6] 46,100		[6] 49,900			96,000		10,000
French Broad River	[6] 1,880,100		470,900			2,351,000		65,000
Little Tennessee River	[6] 482,000		[6] 38,000			520,000	[1] 4	
Tennessee River	[6] 2,200		[6] 31,800			34,000		6,000
Clinch River	[6] 83,000		[6] 14,000			97,000	[1] 2	7,000
Ohio River	63,600	500	115,075	6,800	139,950	325,925		110,000

See footnotes at end of table.

Estimated flood losses and savings for 1940—Continued

River and drainage	Tangible property	Matured crops	Prospective crops	Livestock and other movable farm property	Suspension of business	Total	Lives lost	Reported savings as the result of warnings
MISSISSIPPI SYSTEM—continued								
White Basin								
Black River (Ark.)			$1,000			$1,000		
White River (Ark.)			10,500			10,500		
Arkansas Basin								
Chisholm Creek (Kans.)	$4,000					4,000		
North Canadian River	16,200	$4,500	7,300		$500	28,500		
Canadian River (N. Mex.)	70,000	10,000	8,000			88,000		
Arkansas River	1,120,000	10,000	45,000	$25,000		1,200,000	2	
Red Basin								
Sulphur River	1,500	800	500	1,000	7,000	10,800		$11,000
Ouachita River		500			500	1,000		1,000
WEST GULF OF MEXICO								
Rivers in southwest Louisiana	900,000		4,901,000	644,000		6,445,000		
Trinity River	12,000		3,750			15,750		61,000
Colorado River	154,000	70,000	8,000	2,000		234,000		23,000
Guadalupe River	62,500	98,500	16,000	8,500	1,500	187,000		46,500
Lavaca River	200,000	140,000	315,000	85,000		740,000	7	
GULF OF CALIFORNIA								
Colorado Basin								
Little Colorado River	3,000	1,500		500		5,000		
Salt River	50,000					50,000		
Gila River	75,000				50,000	125,000		
PACIFIC SLOPE								
Sacramento River	3,054,940	683,020	3,100,930	639,440	248,180	7,726,510		2,185,000
Eel River	470,000	500	23,000	6,000	10,000	509,500		13,000
Total	17,792,318	3,547,540	15,998,740	1,791,670	1,336,215	40,466,483	60	6,524,800

[1] From records furnished by the American Red Cross.
[2] Incomplete; severe floods occurred in August in the Yadkin River where 4 lives were lost, but figures on losses are not available.
[3] $200,000 in Cataraugus County, N. Y., in June.
[4] Includes all agricultural losses.
[5] From records furnished by United States engineers.
[6] From records furnished by Tennessee Valley Authority.

CLIMATOLOGICAL DATA

CONDENSED CLIMATOLOGICAL SUMMARY OF TEMPERATURE AND PRECIPITATION BY SECTIONS

[For description of tables and charts, see REVIEW, January, p. 31]

In the following table are given for the various sections of the climatological service of the Weather Bureau the monthly average temperature and total rainfall; the stations reporting the highest and lowest temperatures, with dates of occurrence; the stations reporting the greatest and least total precipitation; and other data as indicated by the several headings.

The mean temperature for each section, the highest and lowest temperatures, the average precipitation, and the greatest and least monthly amounts are found by using all trustworthy records available.

The mean departures from normal temperatures and precipitation are based only on records from stations that have 10 or more years of observations. Of course, the number of such records is smaller than the total number of stations.

Section	Temperature								Precipitation					
			Monthly extremes								Greatest monthly		Least monthly	
	Section average	Departure from the normal	Station	Highest	Date	Station	Lowest	Date	Section average	Departure from the normal	Station	Amount	Station	Amount
	° F.	° F.		° F.			° F.		In.	In.		In.		In.
Alabama	80.6	+.3	2 stations	100	[1] 30	Madison	57	8	7.97	+2.61	Mobile Airport	16.54	Union Springs	2.94
Arizonia	79.0	−1.2	Mohawk	117	[1] 15	Alpine	29	[1] 2	1.64	−.54	Ruby	6.45	Welton	.05
Arkansas	81.2	+.7	Corning	105	2	3 stations	53	[1] 5	4.82	+1.00	Pine Bluff	9.23	Rogers	.80
California	73.4	−.2	2 stations	124	22	Tamarack	28	27	.08	+.01	Happy Camp	1.92	136 stations	.00
Colorado	65.6	−1.6	Sedgwick	104	22	Pearl	23	11	2.31	+.14	Idalia	7.87	2 stations	.26
Florida	81.3	.0	2 stations	101	[1] 9	Mason	63	24	10.02	+2.70	West Palm Beach Airport.	17.74	Key West	3.11
Georgia	80.4	+.4	Eastman	102	31	Blairsville	57	18	7.18	+1.38	Cornelia	14.66	Fort Valley	2.87
Idaho	69.3	+1.2	Lewiston	112	17	Pelton's Ranch	24	31	.73	+.05	Salmon	2.55	Grand View	T
Illinois	77.0	+.5	Mount Vernon	105	30	Sycamore	44	4	2.75	−.49	Harrisburg	6.48	Chester	.70
Indiana	76.4	+.7	Shoals	108	1	4 stations	42	20	2.54	−.78	Cypress	7.48	Kentland	.28
Iowa	75.1	+.4	5 stations	106	[1] 24	Decorah	45	[1] 13	2.24	−1.41	Keosauqua	5.54	New Hampton	.50
Kansas	79.0	−.2	Clay Center	110	22	St. Francis	51	[1] 11	3.05	−.08	Colby	11.04	Medora	.49
Kentucky	76.5	−.6	Earlington	106	2	Farmers	51	21	5.51	+1.32	Williamsburg	13.33	Lovelaceville	2.05
Louisiana	82.0	+.2	Winnfield	102	9	2 stations	61	5	8.04	+1.84	Paradis (near)	14.64	Monroe	3.20
Maryland-Delaware	75.4	+.2	Dundalk, Md	104	28	do	42	[1] 9	5.27	+.94	Solomons, Md	9.22	Chewsville, Md	2.32

See footnotes at end of table.

CONDENSED CLIMATOLOGICAL SUMMARY OF TEMPERATURE AND PRECIPITATION BY SECTIONS—Continued

Section	Temperature: Section average	Temperature: Departure from the normal	Monthly extremes: Station	Highest	Date	Station	Lowest	Date	Precipitation: Section average	Departure from the normal	Greatest monthly: Station	Amount	Least monthly: Station	Amount
	°F	°F		°F			°F		In.	In		In.		In.
Michigan	70.3	+1.9	Adrian	103	27	Kenton	31	8	2.38	−.54	Five Channels Dam	5.00	Coldwater	.61
Minnesota	71.8	+1.7	2 stations	108	[1] 24	Meadowlands	36	[1] 2	2.24	−1.00	Virginia	6.20	Angus	.87
Mississippi	81.4	+.3	Clarksdale	101	1	Eupora	61	11	7.38	+2.22	Bay St. Louis	17.97	Belzoni	2.61
Missouri	79.3	+1.2	Steffenville	110	23	Memphis	46	13	2.75	−.87	Alton (near)	8.16	Philadelphia	.46
Montana	69.2	+2.0	Frazer	108	19	Summit	30	31	1.33	−.07	Conrad	4.96	Heron	.14
Nebraska	75.8	+.3	Weeping Water	111	23	2 stations	42	[1] 2	2.47	−.64	Haigler	7.49	Valparaiso	.50
Nevada	72.6	+.1	Overton	118	21	do	32	[1] 1	.73	+.34	Pioche	2.37	Beowawe Airport	.02
New England	69.5	+.4	Durham, N. H	100	25	Enosburg Falls, Vt	37	3	4.70	+.96	Fitzwilliam, N. H	9.85	Orono, Maine	1.56
New Jersey	73.8	.0	Chatsworth	105	2	Charlotteburg	41	21	6.40	+.171	Trenton No. 2	11.80	Vineland	3.25
New Mexico	70.0	−2.2	Columbus	103	10	Winsor's	28	23	2.75	+.25	Cloudcroft	8.97	Chaco Canyon	21
New York	71.6	+1.8	2 stations	100	27	Hamilton	34	15	4.81	+.92	Southeast Reservoir	12.03	Lewiston	1.70
North Carolina	77.8	+.9	Fayetteville	103	29	Banners Elk	46	21	8.56	+2.63	Mount Mitchell	19.27	Rougemont	3.53
North Dakota	70.8	+1.8	Lisbon	106	25	Leeds	34	11	1.76	−.68	Stanley	5.87	Hettinger	.39
Ohio	75.1	+1.4	Napoleon	105	27	3 stations	44	20	4.15	+.35	Millport	10.15	Holgate	.83
Oklahoma	81.5	−.3	2 stations	108	[1] 18	Miami	51	5	2.24	−.59	Idabel	5.95	Hobart	.32
Oregon	68.2	+1.7	The Dalles	115	16	Fall River	26	29	.54	+.12	Starkey	3.35	16 stations	.00
Pennsylvania	73.1	+.9	Marcus Hook	104	28	Coudersport	29	21	5.11	+.84	George School	16.11	Penn Line	2.19
South Carolina	80.4	+.5	3 stations	101	[1] 30	Caesars Head	57	8	8.54	+2.68	Caesars Head	16.91	Lake City	3.11
South Dakota	75.0	+1.8	2 stations	112	23	2 stations	40	12	1.75	−.66	Deerfield	4.75	Huron	.42
Tennessee	79.4	+1.7	Paris	104	2	Erwin	53	21	7.43	+2.91	Byrdstown	15.82	Jackson No. 1	1.15
Texas	82.0	−1.0	Henrietta	110	31	Mount Locke	51	26	3.56	+.93	Kirbyville (near)	11.58	Port Isabel	.00
Utah	70.6	−1.1	Springdale	109	22	Clear Creek	22	2	1.25	+.33	Central	4.20	Callao	.01
Virginia	76.2	+.8	2 stations	102	[1] 26	Big Meadows	40	23	6.93	+2.28	Pinnacles	14.44	Richmond	3.51
Washington	70.5	+4.0	Wahluke (near)	115	17	Stockdill Ranch	35	[1] 23	.29	−.34	Dayton	2.38	19 stations	.00
West Virginia	74.4	+1.2	Inwood	105	28	Thornwood	37	21	5.39	+.77	Huntington	9.18	Kearneysville	2.07
Wisconsin	71.3	+1.1	4 stations	104	29	Laona	32	20	2.72	−.75	Park Falls	6.75	Lancaster	.92
Wyoming	66.3	+.6	Lagrange	103	23	Northeast Entrance	27	3	1.72	+.38	Timothy McCoy Ranch.	5.49	Elk Mountain	.14
Alaska (June)	54.2	+1.8	Crooked Creek	89	15	Barrow	17	2	1.84	+.12	Little Port Walter	11.73	2 stations	.06
Hawaii	74.9	+1.2	Mahukona (Hawaii)	94	31	Haleakala (Maui)	35	4	4.95	−.99	Kukui (Maui)	24.00	11 stations	.00
Puerto Rico	78.4	+.1	Utuado	98	9	Guineo Reservoir	58	22	6.51	+.50	Canovanas	14.61	Sabana Grande	1.10

CLIMATOLOGICAL DATA FOR WEATHER BUREAU STATIONS

District and station	Elevation of instruments: Barometer above sea level	Thermometer above ground	Anemometer above ground	Pressure: Station, reduced to mean of 24 hours	Sea level, reduced to mean of 24 hours	Departure from normal	Temperature of the air: Mean max.+mean min.÷2	Departure from normal	Maximum	Date	Mean maximum	Minimum	Date	Mean minimum	Greatest daily range	Mean wet thermometer	Mean temperature of the dew point	Mean relative humidity	Precipitation: Total	Departure from normal	Days with 0.01 inch or more	Wind: Average hourly velocity	Prevailing direction	Maximum velocity: Miles per hour	Direction	Date	Clear days	Partly cloudy days	Cloudy days	Average cloudiness, tenths	Total snowfall	Snow, sleet, and ice on ground at end of month
	Ft.	Ft.	Ft.	In.	In.	In.	°F.	°F..	°F.		°F.	°F		°F	°F.	°F.	°F.	%	In.	In.		Miles								0-10	In.	In.
New England							68.1	+1.7										80	4.73	+1.2										6.1		
Eastport	75	67	85	29.86	29.94	+0.01	59.6	−0.8	85	30	68	47	10	51	32	56	54	87	3.57	+0.5	13	7.5	s.	21	sw.	8	11	10	10	5.2	0.0	0.0
Greenville, Maine	1,070	6	41	28.79	29.93	......	65.4	+.4	91	24	79	43	16	52	42	62	58	...	5.83	+1.4	9	......	s.	......	......	...	5	14	12	....	.0	.0
Portland, Maine [1]	103	5	36	29.81	29.93	−.02	68.0	......	98	2	80	49	5	56	40	62	59	78	2.35	−.8	9	6.9	s.	40	w.	25	11	11	9	5.2	.0	.0
Concord [2]	289	54	72	29.63	29.94	−.02	69.8	+1.3	96	25	83	47	21	57	38	64	61	77	3.92	+.4	10	6.1	nw.	21	nw.	2	4	17	10	6.5	.0	.0
Burlington [2]	403	11	48	29.48	29.91	−.03	70.5	+.2	92	24	80	50	3	60	29	65	60	71	6.35	+2.8	11	7.8	s.	26	s.	7	10	6	15	6.0	.0	.0
Northfield	876	12	60	29.01	29.93	−.01	67.4	+1.5	92	24	80	45	3	55	36	....	....	...	5.27	+1.7	10	6.3	sw.	21	se.	19	8	12	11	6.1	.0	.0
Boston [1]	124	33	62	29.81	29.94	−.02	71.4	......	96	2	79	57	15	64	26	65	61	74	2.90	−.5	14	9.6	sw.	26	sw.	7	3	15	13	6.7	.0	.0
Nantucket	12	10	63	29.96	29.97	−.01	66.8	−1.0	79	20	72	56	6	61	17	63	62	89	5.46	+2.6	17	10.4	sw.	36	ne.	29	6	8	17	6.8	.0	.0
Block Island	26	11	46	29.94	29.97	.00	67.9	−.5	80	26	73	57	3	63	16	65	63	88	4.55	+1.5	15	12.6	sw.	44	ne.	29	13	8	10	5.1	.0	.0
Providence [2]	159	62	74	29.79	29.96	−.01	72.8	−.6	98	2	81	55	15	64	29	65	62	80	5.68	+2.4	16	6.0	s.	19	sw.	7	7	13	11	6.3	.0	.0
Hartford [1]	159	5	44	29.78	29.95	−.02	72.7	......	95	1	82	53	21	63	30	67	64	79	6.53	+2.2	12	7.4	sw.	33	sw.	24	4	12	15	6.9	.0	.0
New Haven [2]	107	74	153	29.85	29.96	−.01	72.8	+1.0	95	2	81	58	15	65	26	66	64	82	4.39	+.1	15	7.9	s.	24	s.	19	8	13	10	5.8	.0	.0
Middle Atlantic States							76.3	+0.9										77	5.29	+1.0										6.3		
Albany [1]	97	26	40	29.82	29.93	−.03	73.4	......	97	1	85	49	21	62	36	65	61	69	4.45	+1.0	11	8.2	s.	28	s.	7	4	12	15	6.5	.0	.0
Binghamton	871	57	79	29.06	29.96	−.01	73.2	+3.2	96	27	84	48	21	62	38	66	62	73	6.42	+2.7	12	4.8	w.	22	nw.	28	4	10	17	6.8	.0	.0
New York	314	415	454	29.62	29.95	−.03	74.7	+.9	94	2	82	61	3	68	20	67	63	73	4.60	+.4	15	11.5	s.	44	sw.	7	10	5	16	6.5	.0	.0
Harrisburg [1]	374	30	49	29.57	29.96	−.02	76.1	......	99	28	87	55	22	66	35	68	64	71	2.80	−1.0	8	6.9	w.	32	sw.	30	5	8	18	6.9	.0	.0
Philadelphia [2]	114	174	367	29.85	29.97	−.01	76.4	+.2	97	2	84	61	3	69	24	69	67	78	5.60	+1.4	13	11.3	sw.	52	n.	28	5	14	12	6.2	.0	.0
Reading	323	47	306	29.62	29.96	......	76.0	+.6	99	28	85	59	21	67	28	68	64	70	4.73	+.5	14	9.0	s.	50	nw.	2	6	11	14	6.4	.0	.0
Scranton	805	72	104	29.12	29.97	−.01	73.8	+2.1	96	25	84	51	21	64	34	....	....	...	3.45	−.6	15	5.7	sw.	27	n.	30	7	15	9	5.8	.0	.0
Atlantic City	52	37	172	29.91	29.97	−.01	72.8	+.7	96	28	78	61	5	67	26	68	66	85	3.97	.0	13	14.3	s.	40	ne.	28	8	9	14	6.3	.0	.0
Trenton	190	89	107	29.76	29.96	......	74.8	+.3	98	2	83	57	3	66	25	68	65	76	10.19	+6.2	13	7.8	s.	23	nw.	28	8	7	16	6.3	.0	.0
Baltimore [2]	123	100	215	29.84	29.97	−.01	78.4	+1.2	103	28	86	63	5	70	28	71	68	78	5.61	+1.0	15	9.4	s.	36	nw.	2	8	8	15	6.3	.0	.0
Washington [2]	112	62	85	29.86	29.98	−.02	77.4	+.6	99	28	86	63	5	69	26	71	67	79	5.67	+1.0	14	5.5	sw.	29	nw.	2	9	10	12	5.9	.0	.0
Cape Henry	18	8	54	29.96	29.98	......	77.8	+.3	99	28	85	65	20	71	28	72	71	84	5.14	−.2	18	9.9	sw.	28	w.	19	7	12	12	6.1	.0	.0
Lynchburg	686	144	184	29.27	30.00	−.01	78.6	+1.1	98	26	88	62	22	69	27	71	68	78	8.70	+4.5	17	6.1	sw.	30	ne.	29	4	17	10	6.4	.0	.0
Norfolk [2]	91	80	125	29.89	29.99	−.01	79.1	+.4	97	28	87	67	16	71	24	73	71	85	4.52	−1.2	15	8.9	sw.	30	nw.	19	4	12	15	6.7	.0	.0
Richmond [2]	144	11	52	29.83	29.98	−.03	78.8	+.3	98	28	88	63	22	70	27	72	70	84	3.51	−1.2	14	7.1	sw.	24	nw.	2	6	14	11	6.1	.0	.0

See footnotes at end of table.

CLIMATOLOGICAL DATA FOR WEATHER BUREAU STATIONS—Continued

District and station	Elevation of instruments: Barometer above sea level	Elevation of instruments: Thermometer above ground	Elevation of instruments: Anemometer above ground	Pressure: Station, reduced to mean of 24 hours	Pressure: Sea level, reduced to mean of 24 hours	Pressure: Departure from normal	Temperature of the air: Mean max.+mean min.÷2	Temperature of the air: Departure from normal	Temperature of the air: Maximum	Temperature of the air: Date	Temperature of the air: Mean maximum	Temperature of the air: Minimum	Temperature of the air: Date	Temperature of the air: Mean minimum	Temperature of the air: Greatest daily range	Mean wet thermometer	Mean temperature of the dew point	Mean relative humidity	Precipitation: Total	Precipitation: Departure from normal	Precipitation: Days with 0.01 inch, or more	Wind: Average hourly velocity	Wind: Prevailing direction	Wind: Maximum velocity: Miles per hour	Wind: Maximum velocity: Direction	Wind: Maximum velocity: Date	Clear days	Partly cloudy days	Cloudy days	Average cloudiness, tenths	Total snowfall	Snow, sleet, and ice on ground at end of month
	Ft.	Ft.	Ft.	In.	In.	In.	°F.	°F.	°F.		°F.	°F.		°F.	°F.	°F.	°F.	%	In.	In.		Miles								0-10	In.	In.
South Atlantic States							**80.3**	**+1.2**										**84**	**8.37**	**+2.5**										**6.5**		
Asheville	2,253	89	104	27.73	30.00	−.02	74.8	+3.1	94	29	84	58	21	65	29	68	66	84	9.61	+5.3	20	5.2	nw.	19	s.	4	4	16	11	6.6	.0	.0
Charlotte [2]	779	63	86	29.17	29.98	−.04	79.8	+1.4	96	30	88	67	6	71	22	72	71	83	8.44	+3.3	15	6.2	sw.	17	sw.	3	0	11	20	7.6	.0	.0
Greensboro [1]	886	6	56	29.08	30.00		78.0		96	31	87	64	25	69	26	72	70	85	4.61		14	7.1	sw.	25	n.	12	0	14	17	7.5	.0	.0
Hatteras	11	5	50	30.00	30.01	.00	79.2	+1.0	91	28	84	70	23	74	16	75	74	87	4.13	−1.4	10	11.2	sw.	29	sw.	18	10	9	12	5.5	.0	.0
Raleigh [1]	376	27	69	29.60	30.00	−.02	80.2		99	29	90	64	5	71	26	73	72	84	10.86		16	8.0	sw.	32	sw.	5	1	12	18	7.2	.0	.0
Wilmington	72	73	107	29.94	30.01	.00	80.4	+1.3	96	29	87	70	25	74	20	75	74	85	7.79	+.7	16	9.1	sw.	29	sw.	30	1	22	8	6.3	.0	.0
Charleston [2]	48	11	92	29.96	30.01	−.02	81.6	+.2	99	31	88	71	5	75	19	76	74	86	13.39	+6.5	14	9.0	s.	25	n.	8	6	14	11	6.2	.0	.0
Columbia, S. C. [2]	347	70	91	29.64	30.00	−.02	81.0	+.1	97	31	90	68	6	72	27	75	73	83	8.53	+3.2	17	7.2	s.	24	sw.	30	6	16	9	5.9	.0	.0
Greenville, S. C	1,040	70	78	28.93	30.00		79.1	+2.2	99	31	88	63	8	70	27				7.44	+2.1	15	5.9	sw.	36	n.	8	7	13	11	6.3	.0	.0
Augusta [2]	182	62	77	29.81	30.00	−.02	82.2	+.9	99	31	91	68	5	73	22	74	72	82	6.86	+1.5	11	5.0	s.	20	nw.	8	4	16	11	6.2	.0	.0
Savannah [2]	65	73	152	29.94	30.01	−.02	82.7	+1.2	98	31	91	70	22	74	23	75	73	81	10.83	+4.2	16	8.5	sw.	25	sw.	5	8	14	9	5.7	.0	.0
Jacksonville [2]	43	86	110	29.98	30.03	.00	82.4	+.3	98	30	91	68	6	74	22	76	74	82	6.72	.0	19	6.3	s.	30	sw.	26	2	21	8	6.5	.0	.0
Florida Peninsula							**83.2**	**+1.0**										**81**	**6.15**	**+0.6**										**5.9**		
Key West [2]	21	10	64	30.01	30.03	.00	84.2	+.7	92	31	90	72	3	78	16	78	76	78	3.11	−.2	11	7.3	se.	25	s.	4	8	15	8	5.3	.0	.0
Miami [2]	25	124	168	30.02	30.05	+.01	82.2	+1.2	91	30	87	71	6	77	14	76	74	82	9.44	+4.0	17	8.0	se.	28	se.	16	3	22	6	5.9	.0	.0
Tampa [1]	35	5	61	30.00	30.04	.00	82.2		93	22	88	70	2	76	20	77	75	83	5.89	−2.1	21	9.1	w.	53	se.	2	1	20	10	6.5	.0	.0
East Gulf States							**81.3**	**+0.3**										**84**	**9.89**	**+4.0**										**6.4**		
Atlanta [1]	1,173	5	72	28.79	29.98	−.04	80.0		95	31	89	65	6	71	23	72	70	81	4.99		12	7.2	nw.	39	sw.	4	0	21	10	6.9	.0	.0
Macon [2]	370	79	87	29.61	29.99	−.03	81.1	−.1	97	30	90	67	10	72	27	73	72	85	10.82	+6.1	20	5.7	s.	30	n.	10	0	10	21	7.5	.0	.0
Thomasville	273	49	58	29.73	30.02	−.01	80.5	−1.3	94	31	90	63	22	72	27				6.91	−.2	18		sw.				0	14	17		.0	.0
Apalachicola	35	11	51	29.97	30.01		81.3	−.4	92	31	87	72	24	76	16	76	75	82	9.04	+1.3	19	7.4	w.	28	e.	24	5	11	15	6.8	.0	.0
Pensacola	56	54	79	29.94	30.00	−.01	82.1	+1.1	97	29	89	71	24	75	19	76	74	82	11.31	+4.5	16	6.6	w.	20	w.	15	4	18	9	6.1	.0	.0
Anniston	741	9					79.2	+1.3	93	31	88	61	9	70	32				8.21	+3.0	23		sw.				1	22	8		.0	.0
Birmingham [2]	700	11	48	29.27	29.99	−.02	80.4	+.2	95	9	89	69	6	72	25	73	71	84	10.33	+5.2	21	5.3	s.	21	s.	5	1	19	11	6.7	.0	.0
Mobile [2]	57	86	161	29.94	29.99	−.02	81.9	+.5	97	31	90	70	16	74	21	76	74	87	13.60	+6.7	17	5.7	sw.	22	ne.	17	1	15	15	7.0	.0	.0
Montgomery [2]	218	92	105	29.76	29.99	−.03	81.6	−.1	96	31	90	70	4	73	24	74	73	84	8.04	+3.2	23	6.0	sw.	21	w.	11	8	19	4	5.3	.0	.0
Meridian [2]	375	67	92	29.59	29.98	−.04	81.4	+1.0	96	9	91	69	23	72	25	74	73	85	15.14	+10.2	19	4.6	sw.	22	sw.	12	9	13	9	5.4	.0	.0
Vicksburg [2]	247	82	102	29.72	29.97	−.03	81.4	+.1	94	26	90	70	4	73	21	74	73	87	7.52	+3.0	13	6.0	sw.	25	e.	24	5	13	13	6.4	.0	.0
New Orleans [2]	53	76	84	29.94	29.99	−.01	83.6	+1.2	96	8	91	72	1	76	18	76	74	81	7.91	+1.5	15	5.0	w.	16	nw.	16	2	22	7	6.4	.0	.0
West Gulf States							**83.2**	**+0.8**										**77**	**3.72**	**+0.5**										**4.9**		
Shreveport [2]	249	92	227	29.71	29.97	−.01	83.8	+.6	99	8	94	69	24	74	24	75	73	78	4.00	+.4	8	8.3	sw.	36	se.	2	10	13	8	5.0	.0	.0
Bentonville	1,303	12	51	28.62	29.94	−.03	79.6	+1.1	99	29	91	55	5	68	30				1.32	−3.0	6	5.4	sw.	22	nw.	18	14	11	6	4.0	.0	.0
Fort Smith	463	57	82	29.46	29.92	−.05	83.4	+1.9	100	9	94	63	5	73	26	73	69	68	3.72	+.4	10	5.6	e.	24	w.	2	14	10	7	4.5	.0	.0
Little Rock [2]	357	94	102	29.58	29.96	−.03	81.4	+.5	97	8	90	68	5	72	25	74	72	80	5.97	+2.5	10	6.3	sw.	35	w.	30	7	15	9	5.8	.0	.0
Austin [2]	605	68	90	29.33	29.95		83.6	−.4	97	9	93	68	6	74	24	74	71	76	3.37	+1.0	4	6.5	s.	21	nw.	14	15	13	3	4.2	.0	.0
Brownsville [2]	57	88	96	29.88	29.94		84.8	+1.2	95	5	91	76	5	78	19	77	75	81	.03	−1.9	1	10.2	s.e	25	se.	11	9	20	2	4.7	.0	.0
Corpus Christi [2]	20	11	78	29.94	29.96	.00	85.0	+2.3	94	5	92	75	11	78	18	77	76	86	2.25	+.7	4	10.7	s.	24	ne.	4	22	5	4	3.5	.0	.0
Dallas [1]	512	6	46	29.41	29.94		84.4		100	31	94	68	5	74	26	74	70	69	.76	−2.1	7	8.1	s.	38	sw.	2	16	12	3	3.9	.0	.0
Fort Worth [1]	679	35	56	29.25	29.94	−.02	84.4		102	31	95	66	5	73	28	73	70	69	1.49	−1.1	4	8.4	s.	38	n.	30	15	10	6	4.3	.0	.0
Galveston [2]	54	106	114	29.92	29.97	−.01	83.5	+.1	92	4	88	72	12	79	14	77	75	82	9.11	+5.4	6	8.4	s.	22	w.	12	2	19	10	6.3	.0	.0
Houston [2]	138	157	190	29.83	29.97		84.2	+.5	96	2	92	73	17	76	22	76	74	81	5.21	+1.2	10	7.8	s.	27	n.	16	4	18	9	6.1	.0	.0
Palestine	510	64	72	29.46	29.98	+.01	82.4	+.2	97	17	92	68	6	73	21	74	71	74	2.92	+.2	8	6.0	s.	22	se.	10	17	9	5	4.4	.0	.0
Port Arthur	34	59	134	29.94	29.98		83.0		94	26	89	72	12	77	18	77	75	80	11.37	+4.4	14	9.0	s.	32	sw.	13	3	18	10	6.5	.0	.0
San Antonio [1]	693	28	59	29.24	29.95	.00	84.4		99	8	95	68	6	74	29	74	71	73	.62	−1.6	5	7.3	se.	33	sw.	14	2	23	6	5.7	.0	.0
Ohio Valley and Tennessee							**77.7**	**+1.8**										**75**	**4.12**	**+0.4**										**5.3**		
Chattanooga [1]	762	21	54	29.19	29.98	−.04	79.2		94	10	89	62	18	69	30	73	71	84	11.54		19	4.7	s.	36	w.	31	1	16	14	7.2	.0	.0
Knoxville [2]	995	66	84	28.95	29.98	−.04	79.2	+2.1	98	1	88	64	21	70	25	72	69	77	8.37	+4.0	16	4.7	sw.	21	w.	19	8	14	9	5.5	.0	.0
Memphis [2]	399	78	86	29.53	29.94	−.06	82.5	+1.8	99	8	92	69	19	73	26	74	71	75	3.51	+.3	9	5.6	sw.	24	w.	18	4	15	12	6.4	.0	.0
Nashville [1]	546	5	72	29.39	29.96	−.05	80.6		97	30	90	64	22	71	27	72	70	76	7.12	+3.2	13	6.1	s.	33	nw.	9	6	16	9	5.9	.0	.0
Lexington	989	6		28.96	30.00	−.01	78.0	+2.1	98	27	89	57	21	67	32				7.34	+3.7	14		s.				14	15	2	3.6	.0	.0
Louisville [2]	525	106	120	29.41	29.96	−.04	79.0	+.4	97	30	88	61	21	70	24	70	67	73	2.36	−1.3	11	7.0	sw.	28	nw.	16	14	14	3	4.1	.0	.0
Evansville [1]	431	5	38	29.50	29.95	−.05	78.6		99	1	89	60	17	68	26	71	68	75	4.30	+.9	10	6.0	sw.	40	nw.	18	11	12	8	5.1	.0	.0
Indianapolis [2]	823	98	129	29.10	29.95	−.04	78.0	+2.3	100	29	88	54	20	68	29	68	63	68	1.21	−2.1	5	7.0	sw.	24	sw.	18	13	12	6	4.8	.0	.0
Terre Haute [2]	575	68	149	29.36	29.96		78.4		98	30	89	56	20	68	33	69	65	69	1.53	−1.6	5	7.8	sw.	25	nw.	18	14	10	7	4.6	.0	.0
Cincinnati [2]	627	11	51	29.30	29.96	−.04	77.4	+2.3	99	27	88	56	21	66	28	69	66	71	3.47	+.2	8	5.6	sw.	21	sw.	16	13	9	9	4.8	.0	.0
Columbus [2]	822	90	110	29.10	29.96	−.04	77.4	+2.5	100	27	88	53	20	67	26	67	64	71	2.65	−.9	12	7.7	s.	34	sw.	18	8	11	12	5.6	.0	.0
Dayton [2]	900	186	213	29.03	29.97		76.6	+1.2	98	27	87	53	20	67	28	67	63	70	1.61	−1.7	8	7.6	sw.	34	sw.	10	11	11	9	4.9	.0	.0
Elkins [2]	1,947	61	78	28.00	30.00	−.01	72.1	+1.8	93	27	83	48	21	61	36	66	64	84	5.17	−.2	14	4.8	se.	22	s.	18	3	16	12	6.5	.0	.0
Parkersburg	637	77	84	29.30	29.97	−.04	76.4	+1.0	98	27	87	55	21	66	30	69	66	78	4.84	+.6	14	4.4	se.	27	w.	29	11	11	9	5.2	.0	.0
Pittsburgh [1]	842	39	54	29.08	29.97	−.03	74.4		96	28	84	56	9	65	28	66	62	73	4.22	+.2	12	8.7	s.	34	nw.	30	4	18	9	5.9	.0	.0
Lower Lake Region							**73.0**	**+2.0**										**68**	**3.62**	**+0.3**										**5.1**		
Buffalo [2]	768	243	280	29.14	29.95	−.02	72.1	+2.3	90	26	79	52	20	65	23	64	59	66	3.37	+.3	12	12.3	sw.	38	w.	19	7	16	8	5.5	.0	.0
Canton	448	10	61	29.45	29.91		71.4	+2.5	94	24	83	47	3	60	35	64	59	68	4.60	+1.1	12	7.2	sw.	30	sw.	19	7	14	10	5.9	.0	.0
Ithaca	836	77	100				72.6	+2.1	98	27	85	48	21	61	40				6.42	+2.9	8	7.4	nw.	27	n.	28	8	15	8	5.5	.0	.0
Oswego	335	71	85	29.57	29.93	−.03	71.5	+1.1	93	24	80	55	18	63	30	65	61	72	4.01	+1.1	7	7.7	s.	34	n.	28	10	15	6	4.9	.0	.0
Rochester [1]	523	5	69	29.39	29.94	−.03	73.9		98	25	85	52	20	62	35	65	60	66	3.05	+.1	6	8.3	sw.	35	w.	28	7	13	11	6.2	.0	.0
Syracuse [1]	596	5	51	29.31	29.94	−.03	73.0		95	25	84	51	18	62	34	66	62	70	5.41	+1.7	6	8.1	sw.	41	nw.	28	6	13	12	6.2	.0	.0
Erie [2]	714	57	81	29.21	29.96	−.02	73.6	+2.6	90	27	81	55	9	66	27	66	62	73	2.77	−.2	10	7.0	w.	24	se.	18	11	15	5	4.5	.0	.0
Cleveland [1]	762	27	54	29.16	29.96	−.03	75.2		103	27	86	52	21	64	33	66	62	67	3.34	−.1	11	8.5	s.	37	nw.	30	8	14	9	5.5	.0	.0
Sandusky	629	5	67				75.6	+2.2	99	27	85	55	21	66	27				6.02	+2.6	10	7.1	ne.	25	w.	30	13	12	6	4.5	.0	.0
Toledo [2]	628	79	87	29.29	29.96	−.03	74.5	+1.3	99	27	84	52	20	65	27	66	62	69	1.42	−1.6	9	8.1	w.	30	nw.	16	22	7	2	2.8	.0	.0
Fort Wayne [1]	856	69	84	29.06	29.96		74.3		99	26	87	47	20	62	34	66	61	67	.84	−2.8	6	6.8	n.	24	nw.	18	9	16	6	5.1	.0	.0
Detroit [1]	730	5	78	29.20	29.96	−.02	74.4		100	27	85	51	20	63	30	65	59	62	2.14	−1.2	7	8.1	nw.	32	nw.	10	11	14	6	4.9	.0	.0

CLIMATOLOGICAL DATA FOR WEATHER BUREAU STATIONS—Continued

District and station	Elevation of instruments			Pressure			Temperature of the air												Precipitation			Wind										
	Barometer above sea level	Thermometer above ground	Anemometer above ground	Station, reduced to mean of 24 hours	Sea level, reduced to mean of 24 hours	Departure from normal	Mean max.+mean min.÷2	Departure from normal	Maximum	Date	Mean maximum	Minimum	Date	Mean minimum	Greatest daily range	Mean wet thermometer	Mean temperature of the dew point	Mean relative humidity	Total	Departure from normal	Days with 0.01 inch, or more	Average hourly velocity	Prevailing direction	Maximum velocity: Miles per hour	Maximum velocity: Direction	Maximum velocity: Date	Clear days	Partly cloudy days	Cloudy days	Average cloudiness, tenths	Total snowfall	Snow, sleet, and ice on ground at end of month
	Ft.	Ft.	Ft.	In.	In.	In.	°F.	°F.	°F.		°F.	°F.		°F.	°F.	°F.	°F.	%	In.	In.		Miles								0–10	In.	In.
Upper Lake Region							**70.3**	**+2.3**										**70**	**2.54**	**−0.6**										**5.4**		
Alpena	609	5	89	29.29	29.96	−.01	68.8	+2.9	94	28	78	48	20	59	33	62	58	70	2.20	−.6	9	9.8	nw.	30	se.	18	6	17	8	5.5	.0	.0
Escanaba	612	51	72																													
Grand Rapids [1]	707	70	244	29.20	29.94	−.04	74.4	+2.1	99	26	85	49	20	64	29	64	60	67	4.44	+1.5	10	8.7	sw.	29	sw.	10	13	13	5	4.3	.0	.0
Lansing [2]	878	5	90	29.04	29.97		71.7	+.8	96	27	83	48	20	61	31	64	58	65	.80	−2.3	7	6.7	s.	19	nw.	18	12	12	7	4.5	.0	.0
Marquette	734	44	73	29.16	29.95	−.01	67.6	+2.7	90	23	77	46	2	58	29	62	57	71	3.04	−.1	11	7.7	nw.	22	nw.	23	8	12	11	5.8	.0	.0
Sault Ste. Marie [2]	614	11	52	29.28	29.94	−.03	65.5	+1.7	92	24	77	44	12	54	35	60	56	77	4.35	+1.7	10	9.1	w.	29	sw.	21	7	7	17	6.6	.0	.0
Chicago	673	7	131	29.26	29.97	−.01	73.7	+1.2	98	29	81	55	20	66	29	65	62	70	1.10	−2.2	5	8.8	ne.	25	nw.	29	11	16	4	4.4	.0	.0
Green Bay	617	109	141	29.30	29.96	−.01	72.2	+2.2	99	29	82	49	12	62	29	63	58	64	1.14	−2.3	6	9.3	s.	29	sw.	17	7	10	14	6.2	.0	.0
Milwaukee [1]	681	33	66	29.24	29.97	.00	71.0		98	29	81	51	20	61	28	64	60	71	2.93	+.1	9	9.2	sw.	35	sw.	6	8	16	7	5.4	.0	.0
Duluth	1,133	5	47	28.75	29.95	.00	68.6	+4.7	95	22	78	48	19	59	29	62	59	75	2.86	−.9	9	8.7	ne.	33	nw.	23	7	9	15	6.2	.0	.0
North Dakota							**71.4**	**+3.3**										**66**	**1.46**	**−1.1**										**4.8**		
Moorhead, Minn. [3]	940	50	58	28.93	29.92	−.02	72.5	+4.4	102	25	84	47	2	61	33	64	60	68	1.34	−2.1	7	7.1	s.	29	n.	6	11	13	7	4.9	.0	.0
Bismarck [1]	1,677	4	41	28.19	29.94	+.01	73.3		101	25	87	44	12	60	39	62	56	62	2.32	+.1	7	9.5	nw.	34	nw.	10	9	16	6	5.2	.0	.0
Devils Lake	1,478	11	44	28.39	29.93	.00	70.6	+3.2	99	26	83	40	11	58	34	62	57	70	1.29	−1.3	11	7.2	s.	24	nw.	17	11	11	9	5.5	.0	.0
Lemmon, S. Dak	2,602	4	38	27.28	29.94		73.4		103	22	88	46	12	59	43	60	53		.44		4		nw.				10	12	9		.0	.0
Grand Forks	832	11	71	29.04	29.93		71.4		103	26	85	43	11	58	41	64	60		.77	−2.0	10		s.				11	10	10		.0	.0
Williston	1,878	42	50	27.98	29.92	.00	71.1	+2.2	100	19	84	43	11	59	39	61	55	64	1.56	−.3	11	6.2	se.	23	nw.	20	17	12	2	3.5	.0	.0
Upper Mississippi Valley							**77.0**	**+1.6**										**68**	**1.87**	**−1.6**										**4.9**		
Minneapolis—St. Paul, Minn. [1]	919	32	61	28.97	29.94	−.01	74.7		104	24	85	48	12	64	32	65	61	68	1.98	−1.8	9	8.2	s.	32	ne.	17	7	12	12	5.9	.0	.0
Springfield, Minn	1,075	4	42	28.87	29.94		74.4		105	24	86	47	12	63	32	65	62		2.88		8		nw.				12	8	11		.0	.0
La Crosse [2]	714	11	48	29.19	29.95	−.01	73.6	+.8	96	24	84	53	19	63	29	66	63	74	2.22	−1.7	11	4.4	s.	22	sw.	27	9	11	11	5.6	.0	.0
Madison [2]	974	70	78	28.94	29.97	.00	73.2	+1.1	90	29	83	53	12	64	30	65	61	69	1.09	−2.8	7	6.4	s.	21	nw.	18	6	19	6	5.3	.0	.0
Charles City	1,015	10	51	28.90	29.97	+.01	73.6	+1.3	98	24	85	52	19	62	33	65	61	70	1.94	−1.8	10	5.3	se.	24	sw.	17	12	15	4	4.3	.0	.0
Davenport [2]	606	66	161	29.31	29.96	−.01	76.7	+1.4	101	29	87	56	13	66	27	68	64	69	1.54	−1.8	8	8.0	sw.	31	nw.	10	10	17	4	4.8	.0	.0
Des Moines [2]	860	5	99	29.03	29.94	−.02	77.2	+1.8	104	24	88	54	12	66	32	66	62	65	2.55	−1.0	9	7.6	n.	33	sw.	10	10	15	6	4.8	.0	.0
Dubuque	699	60	79	29.22	29.95	−.02	75.8	+1.7	100	29	86	55	13	65	27	66	61	64	.97	−3.0	6	5.5	s.	18	nw.	29	11	12	8	4.7	.0	.0
Keokuk	614	64	78	29.30	29.94	−.04	78.2	+1.3	104	29	88	59	3	68	31				1.85	−1.6	9	6.3	sw.	34	nw.	10	14	15	2	4.0	.0	.0
Cairo	358	87	93	29.57	29.94	−.06	81.6	+2.0	99	2	91	64	4	72	27				2.54	−.5	6	6.0	sw.	24	sw.	18	5	12	14	6.3	.0	.0
Peoria [2]	609	11	45	29.30	29.95	−.03	77.0	+1.6	102	29	89	53	4	65	32	67	63	68	1.89	−1.7	5	4.8	ne.	23	nw.	10	16	12	3	3.5	.0	.0
Springfield, Ill. [2]	636	5	191	29.29	29.95	−.03	78.8	+2.3	102	29	90	57	4	68	33	68	64	69	2.23	−.6	4	9.6	s.	26	ne.	23	10	12	9	5.4	.0	.0
St. Louis [5]	568	179	303	29.35	29.94	−.05	81.2	+2.4	101	28	91	61	4	71	25	69	63	60	1.68	−1.3	8	9.3	sw.	27	sw.	29	15	11	5	4.1	.0	.0
Missouri Valley							**78.2**	**+1.9**										**67**	**2.31**	**−1.3**										**4.8**		
Columbia, Mo. [2]	784	6	66	29.13	29.95	−.03	78.7	+1.8	102	29	90	59	5	68	29	69	66	71	4.83	+1.3	7	5.9	sw.	18	se.	10	11	16	4	4.2	.0	.0
Kansas City [1]	963	8	76	28.94	29.94	−.03	80.0		103	23	90	59	5	70	29	69	64	65	2.34	−1.8	9	8.7	sw.	50	nw.	8	9	16	6	5.3	.0	.0
St. Joseph [2]	967	11	49	28.93	29.94		79.4		103	23	90	57	12	69	27	70	67	76	1.32	−1.5	9	7.0	s.	24	n.	8	10	12	9	4.9	.0	.0
Springfield, Mo. [1]	1,324	5	60	28.60	29.96	−.02	78.1	+1.3	99	23	90	53	5	66	30	69	66	73	3.42	−.8	7	8.7	s.	42	n.	8	9	18	4	4.7	.0	.0
Topeka	987	65	87	28.91	29.93		81.2	+3.4	106	23	93	59	12	69	31	69	64	63	1.38	−2.9	6	7.4	s.	20	sw.	26	9	11	11	5.4	.0	.0
Lincoln [2]	1,189	11	81	28.69	29.92	−.03	78.8	+2.3	105	23	90	53	12	68	31	67	62	63	.50	−3.3	7	7.9	s.	32	w.	30	12	11	8	4.8	.0	.0
Omaha [1]	1,105	31	44	28.80	29.95	.00	77.2		101	23	88	53	12	66	32	68	64	68	2.70	−.8	9	8.7	se.	56	nw.	10	11	15	5	4.6	.0	.0
Valentine	2,598	46	54	27.30	29.96	+.03	74.2	+.5	100	22	87	51	12	62	34	63	58	64	3.76	+.8	11	7.9	s.	26	nw.	4	12	14	5	4.3	.0	.0
Sioux City [1]	1,138	5	27	28.76	29.94	−.01	75.4		101	25	87	53	12	64	35	67	63	69	2.31		7	7.0	se.	37	n.	10	11	10	10	5.1	.0	.0
Huron [1]	1,301	26	41	28.57	29.92	−.02	77.2		108	23	90	46	12	64	37	64	56	55	.42	−2.7	8	12.3	s.	42	s.	20	12	13	6	4.7	.0	.0
Northern Slope							**72.7**	**+3.6**										**57**	**1.95**	**+0.4**										**4.6**		
Billings [1]	3,570	18	39	26.36	29.93		72.9		98	19	87	48	1	59	36	58	49	52	1.17		8	8.9	sw.	35	nw.	7	11	15	5	4.6	.0	.0
Havre	2,507	11	67	27.36	29.93	+.02	73.4	+5.1	101	18	88	51	9	59	38	59	51	54	1.11	−.8	9	7.7	w.	32	sw.	28	12	14	5	4.6	.0	.0
Helena [1]	4,124	5	35	25.86	29.98	+.05	69.2		98	17	84	47	1	54	40	56	49	57	2.29	+1.2	7	8.1	w.	44	sw.	28	12	12	7	4.7	.0	.0
Missoula [2]	3,263	80	91	26.67	29.97		72.2	+4.6	101	18	87	51	9	57	39	57	50	59	1.38	+.4	10	6.3	se.	38	s.	28	15	10	6	4.0	.0	.0
Kalispell	2,973	48	56	26.96	29.94	+.01	69.3	+5.2	100	17	84	49	12	55	37	56	47	53	1.07	.0	10	6.3	w.	22	s.	6	11	17	3	4.1	.0	.0
Miles City [2]	2,371	48	55	27.48	29.91	−.01	76.5	+3.6	104	19	90	55	11	63	36	61	52	53	2.02	+.5	9	6.0	nw.	25	nw.	28	10	17	4	4.8	.0	.0
Rapid City [2]	3,259	50	58	26.65	29.93	.00	73.7	+2.7	102	22	85	51	13	62	35	61	54	57	1.11	−1.3	9	6.8	w.	26	n.	29	10	18	3	4.4	.0	.0
Cheyenne [1]	6,094	5	39	24.13	29.97	+.05	67.8		93	22	82	48	2	54	39	55	50	64	2.08	.0	16	8.3	nw.	35	w.	8	4	18	9	6.0	.0	.0
Lander	5,352	60	68	24.76	29.97	+.05	68.8	+1.4	95	22	83	48	3	54	39	55	48	56	1.14	+.4	6	5.1	sw.	24	n.	12	9	17	5	5.0	.0	.0
Sheridan [6]	3,790	6	42	26.15	29.94		72.3	+3.9	99	22	87	50	13	58	36	58	50	55	1.94	+.7	9	7.4	nw.	36	nw.	10	11	15	5	4.9	.0	.0
North Platte [2]	2,821	11	51	27.09	29.94	+.01	75.1	+2.2	99	29	87	49	12	63	35	64	60	70	5.35	+2.6	12	6.5	s.	24	sw.	4	13	14	4	3.7	.0	.0
Middle Slope							**80.2**	**+1.1**										**60**	**2.31**	**−0.5**										**4.8**		
Denver [1]	5,292	106	113	24.84	29.95	+.04	72.9		93	23	84	48	1	62	29	57	49	54	1.86	+.2	7	7.2	s.	33	nw.	9	11	18	2	4.4	.0	.0
Pueblo [1]	4,690	5	36	25.36	29.94	+.03	73.2		95	8	88	52	13	58	39	59	52	59	2.06	+.1	15	8.0	w.	32	se.	2	6	22	3	4.7	.0	.0
Concordia	1,392	50	58	28.50	29.93	−.02	80.2	+2.2	103	29	92	58	12	69	30	67	60	56	1.78	−2.0	5	6.7	s.	22	ne.	5	11	13	7	5.0	.0	.0
Dodge City	2,509	10	86	27.40	29.92	−.01	78.2	−.2	99	9	90	59	3	67	33	66	60	60	4.65	+1.5	5	9.3	s.	28	s.	5	8	10	13	5.8	.0	.0
Wichita [1]	1,358	6	64	28.54	29.94	−.02	80.0	+.6	103	29	92	60	3	68	38	68	64	66	2.41	−1.0	7	11.4	s.	52	nw.	10	11	11	9	5.0	.0	.0
Oklahoma City [2]	1,214	10	47	28.69	29.94	−.02	82.5	+1.9	104	30	93	63	5	72	29	70	66	64	1.08	−1.8	5	7.3	s.	26	n.	18	14	13	4	4.2	.0	.0
Southern Slope							**80.0**	**−1.2**										**66**	**3.61**	**+1.2**										**4.6**		
Abilene [2]	1,738	10	56	28.17	29.93	.00	82.7	−.1	100	31	94	67	11	72	28	70	66	68	3.89	+1.8	5	7.7	s.	22	ne.	10	13	10	8	4.5	.0	.0
Amarillo [2]	3,676	10	49	26.32	29.94	+.02	75.3	−1.5	95	18	87	59	6	63	29	66	62	70	3.36	+.5	13	10.4	s.	50	ne.	18	9	21	1	4.5	.0	.0
Del Rio	960	63	71	28.92	29.88	−.02	85.0	−1.3	99	10	95	68	14	75	28	72	67	61	3.35	+.9	5	9.3	se.	30	w.	1	7	18	6	5.3	.0	.0
Roswell	3,566	75	85	26.40	29.94	+.06	76.8	−2.1	95	10	89	60	12	64	30	65	60	63	3.83	+1.6	10	6.5	s.	25	se.	30	14	13	4	4.2	.0	.0
Southern Plateau							**85.1**	**+0.1**										**46**	**1.02**	**+0.1**										**3.0**		
El Paso [2]	3,778	82	101	26.19	29.87	+.03	80.9	−.2	99	9	92	63	14	70	29	64	56	54	1.40	−.6	8	8.0	e.	25	e.	27	12	13	6	4.6	.0	.0
Albuquerque [1]	5,314	5	34	24.82	29.88		76.0		94	29	90	56	7	62	34	59	50	50	2.15	+.7	7	8.2	se.	40	se.	11	5	24	2	4.9	.0	.0
Phoenix [2]	1,107	39	87	28.67	29.78	.00	89.8	.0	110	14	104	67	1	76	38	67	56	40	1.39	+.3	5	5.6	e.	29	nw.	8	21	7	3	3.0	.0	.0
Yuma	142	9	54	29.64	29.78	+.02	91.9	+1.1	115	5	107	66	1	77	40	71	60	42	.17	.0	1	5.5	s.	25	se.	23	27	2	2	1.1	.0	.0
Independence	3,957	5	26	25.94	29.88	+.05	77.7	−.4	101	22	94	53	27	62	36	56	37		T.	−.1	0		se.				22	8	1	1.4	.0	.0

See footnotes at end of table.

CLIMATOLOGICAL DATA FOR WEATHER BUREAU STATIONS—Continued

District and station	Elevation of instruments			Pressure			Temperature of the air									Mean wet thermometer	Mean temperature of the dew point	Mean relative humidity	Precipitation			Wind					Clear days	Partly cloudy days	Cloudy days	Average cloudiness, tenths	Total snowfall	Snow, sleet, and ice on ground at end of month
	Barometer above sea level	Thermometer above ground	Anemometer above ground	Station, reduced to mean of 24 hours	Sea level, reduced to mean of 24 hours	Departure from normal	Mean max.+mean min.÷2	Departure from normal	Maximum	Date	Mean maximum	Minimum	Date	Mean minimum	Greatest daily range				Total	Departure from normal	Days with 0.01 inch, or more	Average hourly velocity	Prevailing direction	Maximum velocity: Miles per hour	Maximum velocity: Direction	Maximum velocity: Date						
	Ft.	Ft.	Ft.	In.	In.	In.	°F.	°F.	°F.		°F.	°F.		°F.	°F.	°F.	°F.	%	In.	In.		Miles								0-10	In.	In.
Middle Plateau							**74.3**	**+1.4**										**44**	**0.92**	**+0.4**										**3.4**		
Reno [2]	4,527	61	76	25.49	29.94	+.07	72.8	+2.7	98	21	88	45	28	57	40	54	44	52	.20	−.1	3	5.6	w.	26	s.	14	24	5	2	2.2	.0	.0
Tonopah	6,090	12	20	24.12	29.91		74.1		96	22	86	48	28	62	30	52	34		.43		3		se.				14	15	2		.0	.0
Winnemucca	4,339	5	56	25.63	29.89	−.01	74.4	+3.8	102	22	92	49	29	56	48	55	40	38	1.47	+1.3	5	7.4	sw.	31	s.	26	19	9	3	3.5	.0	.0
Modena	5,473	10	46				69.3	−1.3	97	22	87	44	3	52	44				1.45	+.4	11	9.1	w.	30	ne.	23	15	10	6	4.0	.0	.0
Salt Lake City [2]	4,357	86	210	25.64	29.90	.00	77.6	+1.9	102	23	91	55	2	64	34	58	46	43	1.14	+.6	6	8.6	se.	43	w.	26	19	8	4	3.3	.0	.0
Grand Junction	4,602	60	68	25.43	29.94	+.05	77.4	−.3	99	23	91	57	2	63	32	59	49	43	.35	−.3	3	6.7	se.	33	sw.	4	11	18	2	3.9	.0	.0
Northern Plateau							**75.9**	**+5.5**										**48**	**0.40**	**−0.2**										**3.1**		
Baker [2]	3,471	36	54	26.56	29.97	+.02	69.4	+3.8	99	16	86	46	9	53	40	56	48	63	.71	+.1	6	5.7	s.	26	sw.	6	22	6	3	2.5	.0	.0
Boise [1]	2,739	5	49	27.12	29.89	−.04	75.4		101	17	90	53	9	60	37	59	48	43	.11		3	8.6	nw.	43	se.	2	16	12	3	3.2	.0	.0
Pocatello [1]	4,478	5	31	25.51	29.93	+.01	71.8		98	22	88	49	1	56	42	56	46	48	1.01	+.2	4	8.5	sw.	34	nw.	11	12	13	6	4.5	.0	.0
Spokane [1]	1,929	27	42	27.94	29.92	−.04	73.8		104	16	89	51	10	58	39	59	49	50	.09	−.6	3	6.9	ne.	32	sw.	6	16	13	2	3.4	.0	.0
Walla Walla	991	57	65	28.86	29.90	−.07	79.4	+5.4	108	17	93	58	1	66	39				.00	−.3	1	6.0	s.	24	w.	6	21	9	1	2.4	.0	.0
Yakima	1,076	58	67	28.79	29.92		78.8	+7.4	107	17	93	57	23	65	34	60	47	37	.09	−.2	1	7.4	nw.	25	se.	18	20	10	1	2.4	.0	.0
North Pacific Coast Region							**66.9**	**+4.9**										**69**	**0.21**	**−0.5**										**4.4**		
North Head	211	5	56	29.84	30.07	−.01	61.0	+3.8	83	14	66	51	13	56	27	58	56	85	.25	−.7	6	12.5	n.	32	n.	30	3	12	16	7.0	.0	.0
Seattle [2]	125	90	321	29.90	30.03	−.01	69.6	+6.5	100	16	80	54	31	59	34	60	55	65	.36	−.3	3	7.1	n.	20	s.	28	16	11	4	3.8	.0	.0
Tacoma	194	172	201	29.83	30.03	−.03	68.5	+5.7	94	17	78	52	31	58	28				.09	−.5	2	7.4	n.	26	sw.	17	10	16	5	4.5	.0	.0
Tatoosh Island	86	9	61	29.97	30.06	+.01	58.0	+2.9	76	15	63	50	13	53	23	56	55	91	.63	−.9	6	9.8	sw.	34	s.	17	9	6	16	6.1	.0	.0
Medford [1]	1,329	29	58	28.57	29.94		74.3		103	14	91	48	24	57	44	60	50	51	.06	−.3	1		nw.				19	8	4	2.6	.0	.0
Portland, Oreg. [2]	154	68	106	29.84	30.01	−.04	72.8	+6.1	103	15	84	53	29	61	34	62	56	64	T.	−.6	0	6.2	nw.	18	nw.	30	13	15	3	3.9	.0	.0
Roseburg	510	45	76	29.45	29.99	−.04	71.6	+4.2	103	16	86	48	29	57	40	60	53	60	.09	−.2	4	4.9	n.	19	w.	17	20	6	5	3.0	.0	.0
Middle Pacific Coast Region							**64.9**	**+2.5**										**66**	**0.02**	**0.0**										**4.0**		
Eureka	60	72	88	29.96	30.03	−.02	57.8	+2.3	65	16	62	51	24	54	13	55	53	89	.06	−.1	4	6.9	n.	22	nw.	31	5	9	17	7.0	.0	.0
Redding [1]	722	20	34	29.10	29.86		83.5		106	22	97	58	27	70	31	64	51	36	T.	−.1	0	7.6	nw.	22	nw.	6	24	5	2	2.1	.0	.0
Sacramento [2]	66	92	115	29.79	29.86	−.02	76.6	+3.4	105	22	93	55	28	60	40	62	53	53	.00	.0	0	7.9	s.	24	sw.	23	29	2	0	0.7	.0	.0
San Francisco	155	112	132	29.77	29.94	−.01	60.2	+1.7	71	7	65	53	3	55	15	56	54	85	.01	.0	1	10.5	w.	28	w.	2	6	17	8	6.1	.0	.0
South Pacific Coast Region							**74.2**											**63**	**0.02**	**0.0**										**2.7**		
Fresno [1]	327	5	35	29.51	29.84	+.01	82.4		108	6	100	59	28	65	39	64	51	41	.00	.0	0	6.4	nw.	21	nw.	23	28	3	0	0.8	.0	.0
Los Angeles	338	223	250	29.56	29.92	+.02	70.7	+.5	88	19	82	56	4	60	28	62	58	70	T	.0	.0	5.6	w.	17	s.e	23	19	9	3	3.1	.0	.0
San Diego [1]	87	20	55	29.83	29.93	+.01	69.4		79	19	76	58	4	62	18	64	61	77	.06	.0	2	7.1	w.	17	nw.	15	18	8	5	4.1	.0	.0
West Indies																																
San Juan, P. R.	82	10	54	29.97	30.06		79.2	−.9	86	26	84	72	30	75	12				7.05	+.1	20	13.2	e.	31	ne.	18	3	17	11	6.3	.0	.0
Panama Canal																																
Balboa Heights	118	6	92		[3] 29.83	.00	80.9	+.6	91	4	87	71	7	75	17			[3] 89	6.05	−1.1	19	5.8	nw.	24	n.	22	0	17	14	7.7	.0	.0
Cristobal	36	6	97		[3] 29.84	.00	81.7	+1.3	91	9	86	74	19	77	16	77	76	[3] 88	20.89	+5.3	29	7.2	w.	24	n.	22	0	1	30	9.5	.0	.0
Alaska																																
Anchorage	132	6	47	[4] 29.78	[4] 29.92		57.0	.0	71	3	64	38	28	50	30	53	49	77	1.88	+.2	16	5.5	s.	18	se.	14	2	6	23	7.9	.0	.0
Barrow	13	4	27	[4] 29.82	[4] 29.83		34.6	−5.4	50	21	38	28	31	31	16	34	33		.63	−.3	12	10.5	e.				2	4	25	8.3	T.	.0
Bethel	38	6	32	[4] 29.85	[4] 29.88		53.3	−1.0	72	12	60	37	12	46	35	51	48	82	2.32	.0	18		nw.				1	1	29	9.2	.0	.0
Fairbanks	482	11	87	[4] 29.36	[4] 29.87		58.6	−1.4	80	13	68	37	28	50	30	52	48	73	1.78	−.1	20	6.4	sw.	28	sw.	16	1	12	18	8.0	.0	.0
Juneau	80	96	116	[4] 29.97	[4] 30.06		56.7	−.4	72	16	62	49	30	52	19	53	50	81	7.29	+2.2	22	5.4	s.	21	w.	17	0	0	31	9.5	.0	.0
Ketchikan	75	69	85	[4] 30.05	[4] 30.07		59.7	+2.1	86	15	66	47	3	53	28	55	52	77	8.02	.0	15	7.4	w.	22	nw.	24	4	6	21	7.6	.0	.0
Nome	22	30	56	[4] 29.81	[4] 29.83		49.5	−.5	68	13	55	36	6	44	20	47	45	85	1.37	−1.4	11	10.0	w.	28	sw.	24	1	9	21	8.2	.0	.0
Hawaiian Islands																																
Honolulu	38	86	100	29.95	29.99		78.6	+.9	86	26	83	72	26	74	14	70	66	69	.19	−1.0	8	10.0	e.	23	ne.	1	11	18	2	4.4	.0	.0

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Alaska																																
Anchorage	132	6	47	[4] 29.71	[4] 29.86		55.4	+2.0	71	3	62	40	1	49	21	52	48	77	2.62	+1.9	14	5.0	w.	18	s.	3	1	9	20	8.0	.0	.0
Barrow	13	4	27	[4] 29.92	[4] 29.93		33.3	+1.3	62	22	39	17	2	28	28	32	30		.06	−.2	3	10.4	e.				4	11	15		T	.0
Bethel	38	6	32	[4] 29.81	[4] 29.82		55.4	+2.3	79	10	67	34	1	44	37	51	47	72	1.36	+.2	12		s.				3	6	21	7.7	.0	.0
Ketchikan	75	69	85	[4] 29.95	[4] 29.97		56.0	+1.6	78	22	63	42	15	50	31	52	49	81	8.15	+1.6	22	6.2	se.	26	se.	1	1	5	24	8.5	.0	.0

[1] Data are airport records.
[2] Barometric data (adjusted to old city elevation) and hygrometric data from airport; otherwise city office records.
[3] Observations taken bihourly.
[4] Pressure not reduced to mean of 24 hours.
[5] Barometric data from airport records, other data from city office records.
[6] Wind, and clear, partly cloudy and cloudy data from city office records, other data from airport.

NOTE.—Except as indicated by notes, 1, 2, 5, and 6, data in table are city office records.

SEVERE LOCAL STORMS, JULY 1941

[Compiled by MARY O. SOUDER]

[The table herewith contains such data as has been received concerning severe local storms that occurred during the month. A revised list of tornadoes will appear in the United States Yearbook]

Place	Date	Time	Width of path, yards	Loss of life	Value of property destroyed	Character of storm	Remarks
Cortland, N. Y	1					Thunderstorm	Many trees and limbs blown down, causing much damage to phone and power lines.
Boaz, N. Mex	2	4 p. m	50	0	$1,000	Tornado and hail.	Large trees uprooted; several small buildings demolished.
Grenville, N. Mex	2	4:20-7 p. m	[1] 4		15,000	Hail and rain	Loss to crops.
Pueblo, Colo., and vicinity.	2	4:30-4:50 p. m			155,000	Hail	The storm center was in the 1700-1900 blocks of the Park Hill district. Florists estimated about 16,000 square feet of glass in greenhouses were knocked out with much damage to perennial gardens and flowers. Loss to crops, $125,000; property damage, $30,000.
Walsenburg, Colo	2	6 p. m	[1] 1		40,000	Heavy hail	Loss in winter wheat; some property damage.
Waterdale, Colo	3	3 p. m	[1] 2		16,000	do	Loss to grain crops, $16,000; some roofs damaged.
Brush, Akron, and Fleming, Colo.	3	4 p. m	[1] 2-4		45,000	do	Loss in small grain.
Blaine County, Mont	3	4-5 p. m	[1] 4		50,000	Heavy hail and rain.	Loss in sugar beets, grain, and garden crops; path 7 miles long.
Boise City, Okla., and vicinity.	3	4-6 p. m	[1] 3		15,000	Hail	Loss confined to crops practically all to winter wheat; path 25 miles long.
Genoa, Colo	3-5	P. m	[1] 1-3			Heavy hail	About 50 percent of grain crops destroyed.
Clayton, N. Mex	4	2:45-4:50 a. m			8,400	Rain and electrical.	Loss to crops, $8,000; damage to roads, $200; loss to livestock, $200.
Walworth, Potter, Hughes, and Washabaugh Counties, S. Dak.	4	4-9 p. m			15,000	Heavy hail and rain.	Partial or complete loss to crops in places; some buildings wrecked; path narrow.
Haxtun, Colo	4	4 p. m	[1] 5		21,000	Heavy hail	Property damage, $1,000; loss in winter wheat, $20,000.
Lyon, Redwood, Brown, Watonwan, Blue Earth, and Martin Counties, Minn.	5	3-6:30 p. m			80,000	Thundersquall and hail.	Property damaged by wind, $5,000; hail damage, $75,000.
Rencona and Villanueva, N. Mex.	6	1-4 p. m	880		1,300	Heavy hail	Loss to crops.
Lamar, Colo	6	2 p. m	[1] 8		10,000	do	Loss in grain, alfalfa, and row crops.
Waterloo, Iowa	7	1:40 p. m			32,000	Hail and wind	Loss in crops, $20,000; property damaged.
Vanderburg County, Ind	7	3 p. m	[1] 5		2,000	do	Property damaged, $2,000; small crop loss.
Tipton County, Ind	7	5 p. m	[1] 1		20,000	do	Loss to crops.
Hamilton County, Ind	7	6:30 p. m	[1] 4		2,000	Wind	Do.
Oskaloosa, Iowa, vicinity of.	7	P. m			2,000	Electrical	Barn burned.
Cleveland, Ohio	7	do		3	10,000	Wind, heavy rain, electrical.	This storm general over the State; 3 persons killed by lightning.
Rush County, Ind	7	7:30 p. m	1,320		4,000	Wind	Property damage, $1,000; loss to crops, $3,000.
Hancock County, Ind	7				500	Wind and hail	Loss to crops, $500; property damaged.
Cedaredge, Colo	8	4:30 p. m	1,320		20,000	Heavy hail	Loss in grain and fruit.
Loveland, Colo	8	5 p. m	[1] 5		50,000	do	Loss in wheat, corn, alfalfa, and cherries.
Fairview, Powhattan and Hiawatha, Kans.	9	4:30-6 p. m	[1] 3		15,000	do	Property damaged; path 15 miles long.
Lynch, Nebr	9	10:30 p. m	2,540		25,600	Wind and hail	Loss to crops; property damaged.
Calhoun County, Iowa	10	3 a. m	[1] 6		150,000	do	Hail caused great damage to crops ranging up to 50 percent of corn and estimated as cutting oat yields from 5 to 15 bushels per acre. This reported to be the worst storm since July 1911.
Antelope County, Nebr	10	do	[1] 2		10,000	Hail	Loss in corn and wheat.
Monona County, Iowa	10	4:55 a. m	[1] 4		25,000	Wind and hail	Damage to buildings by wind, $25,000; loss in crops not estimated.
Des Moines, Iowa	10	7:30 a. m			500	Thunderstorm	Streets flooded, delaying traffic; wires and trees down; roof of church struck by lightning and burned.
Cedar County, Iowa	10	11 a. m	[1] 2		15,000	Wind, rain and hail.	Buildings on 6 farms wrecked or damaged. Heavy rain flooded fields and caused some damage to crops and roads.
Olpe to Neosho Rapids, Kans., and vicinities.	10	3 p. m			15,000	Heavy hail	Loss in crops over a path 15 miles long.
Kingfisher, Okla	10	3:15-4:15 p. m	1,800		750	Straight-line-wind and rain.	Property damaged.
Berthoud to Fort Collins, Colo.	10	4:30 p. m	[1] 2		102,500	Heavy hail	Small grains, row crops, fruit and beets heavily damaged; loss over $100,000; property damage, $2,500.
Fairmount, Minn., and vicinity.	10	do	[1] 3		12,600	Thundersquall and hail.	Loss to crops from hail to Martin County, $10,000; path 20 miles long.
Wisner to Beemer, Nebr	10	5 p. m	440		1,500	Hail	Loss to grains over a small area.
Roscoe to Nolan, Tex	10	5:30-6:30 p. m	[1] 1-3			do	Much loss in cotton, sorghum, and grain crops; amount unknown.
Wichita, Kans., 10 miles north.	10	5:40-6 p. m	[1] 10		8,000	Wind and hail	An extreme wind velocity of 63 miles per hour recorded. Property damaged; path 40 miles long.
Schuyler, Nebr., vicinity of.	10	6-7 p. m	[1] 1		5,000	Hail	Principal loss in barley and oats over an area about 10 miles long.
Maxwell, N. Mex	11	3 p. m	[1] 2		10,000	do	Loss to crops.
Pondera County, Mont	11	3-4:15 p. m	2,640		3,000	Hail and rain	Chief damage to gardens, wheat, oats and alfalfa; path 3 miles long.
Juan Tonas to Chilili, N. Mex.	11	P. m	[1] 1		6,000	Heavy hail	Loss in corn and pinto beans; path 10 miles long.
Mayhill, N. Mex	12	Noon-4 p. m			2,300	do	Loss in crops, $1,800; damage to farm land, $500.
Canon City, Colo	12	1 p. m	1,320		1,000	do	Loss in fruit and crops.
Craig, Colo	12	4 p. m	[1] 5		900	do	Loss in small grain.
Taos Canyon, N. Mex	12	4:15-5 p. m	3,089		1,000	do	Loss in crops.
Huntington, Ohio	12	6:25-8:30 p. m			9,500	Thunderstorm	3.24 inches of rain recorded. Damage by lightning, flooding of basements and crumbling of foundations, estimated at $8,000. Damage by landslides and clogging of sewers, $1,500.
Trinidad, Colo	13	3:15 p. m	[1] 4		10,000	Heavy hail	Loss in small grains and beans.
Villanueva and Sena, N. Mex.	15	2-4 p. m	[1] 2		1,500	do	Loss in crops.
Cerro Gordo County, Iowa.	17	7 p. m	[1] 1		25,000	Hail, rain, and wind.	Property damaged; trees, shrubs, corn, small grain, and truck damaged by hail and rain. Greatest damage in area 1 mile wide.
Winnebago County, Iowa	17	do	[1] 10		30,000	Hail and wind	A farm residence and outbuildings badly damaged; lesser damage at other locations. Much loss to crops on at least 60 farms; total loss unknown, but may be near $75,000. This reported to have been one of the worst hailstorms of record in this county.
Gamerco, N. Mex	17	12:15-12:40 p. m.	[1] 2		1,500	Heavy hail	Loss to crops.
Central and extreme southwestern counties, Minnesota.	17	2:30-7:30 p. m			767,000	Thundersqualls and hail.	Damage to property from wind over a path 3 miles wide and from 40 to 200 miles long was $17,600. Hail damage to property and loss to crops over a path 20 to 55 miles long was $749,400.
Floyd County, Iowa	17	9 p. m	[1] 1		5,000	Wind and hail	Electric service interrupted; wires and trees down; property damaged. Loss estimated at one-third of crops in an area 6 or 7 miles long.
Linn County, Iowa	17	10 p. m	880		30,000	Wind, hail, and rain.	Property damaged; 2 radio towers, built to stand high wind and valued at $7,500 each, blown down.
Minneapolis and St. Paul, Minn., and vicinity.	17	P. m			3,000	Electrical	Several places struck by lightning and damaged.
Minnehaha County, S. Dak	17	do	2,640		2,000	Wind and hail	Damage to farm buildings; loss to crops negligible; path 5 miles long.

[1] Miles instead of yards.

SEVERE LOCAL STORMS, JULY 1941—Continued

Place	Date	Time	Width of path, yards	Loss of life	Value of property destroyed	Character of storm	Remarks
Hancock County, Iowa	17				2,000	Wind, hail, electrical.	Barn burned; some loss in crops.
Columbia, S. C., and vicinity.	17				20,000	Rain and flood	Streets, roads, and property damaged; 3.71 inches of rain recorded.
Mays County, Okla	18	4 p. m.	[1] 3		2,000	Hail	Loss in crops, $1,900; property damage, $100; path, 6 miles long.
Crescent, Okla., northeast of.	18	4:10 p. m.	[1] 2		40,000	Wind and hail	Crop loss, $35,000; property damage, $5,000; path, 12 miles long.
Posey and Vanderburgh Counties, Ind.	18	5 p. m.	[1] 2		25,000	do	Crop damage, $10,000; property damage, $15,000.
Columbia County, Wash	18				75,000	Hail	Report made on combined damage from 2 storms.
Walla Walla, Franklin and eastern Benton Counties, Wash.	18				40,000	Electrical	Pasturage ruined; wheat burned.
Ithaca, N. Y., and vicinity	19					Thunderstorm	Lightning and falling trees caused much damage to telephone and power lines.
Virden, N. Mex	20	4:05–4:35 p. m.	587		8,500	Heavy hail	$8,000, loss to crops; $500, damage to roofs.
Ainsworth, Nebr	20	6–7 p. m.	[1] 3		25,000	Hail and wind	Chief damage to corn from hail; property damaged; path 9 miles long.
Progresso and Cedarvale, N. Mex., vicinity of.	21	4–5:30 p. m.	[1] 1–3		10,000	Heavy hail	Loss to crops.
Raymond, Nebr	21	6 p. m.	[1] 1		4,000	Wind and hail	Loss in small grain from hail; property damaged; man injured.
Weeping Water, Nebr., vicinity of.	21	7 p. m.	[1] 1		4,000	do	All small buildings on a farm leveled; loss to corn and other crops on 2 farms.
Truchas, N. Mex	21		[1] 2		2,000	Heavy hail	Loss in crops.
Kenosha County, Wis., southeastern portion.	22				700	Thundersquall	Loss to crops, $500; property damage, $200.
Ada, Minn., and vicinity	23	11:30 p. m.			20,000	Thundersquall and hail.	Loss to growing crops from hail, $5,000; property damages by wind, $15,000; path 5 miles long.
Molson, Wash	24	4:30 p. m.	[1] 1		3,000	Hail	Property damaged.
Vanderburg County, Ind	24				8,500	Wind	Crop loss, $4,000; property damage, $4,500.
Prairie and Dawson Counties, Mont.	25	5 p. m.			40,000	Heavy hail	Loss in wheat; path 20 miles long.
De Soto to Linwood, Kans., and vicinities.	26	2:30 p. m.	[1] 2	0	4,000	Tornado	A vortex cloud observed; property damaged; path 8 miles long.
Madison, Fla., 4 miles north.	26	3 p. m.	33	0	600	do	Crop loss, $100; property damaged, $500; path from 2 to 3 miles long.
Prairie and Dawson Counties, Mont.	27	2–5 p. m.			30,000	Wind and hail	Loss chiefly in wheat; property damaged; path 50 miles long.
Fergus County, Mont	28	3–6 p. m.			250,000	Heavy hail	Loss principally in wheat. Storm traveled a narrow strip north of Denton to the Missouri River northeast of Winifred; path 50 miles long.
New York State, western, central, and northern portions.	28			1		Severe thunderstorm.	In Jefferson County hundreds of trees were blown down, miles of telephone and power lines leveled and much damage to houses and barns. Many highways blocked by fallen trees. There was much damage in Syracuse, Cortland, and Ithaca. Numerous fires caused by lightning reported.
Marietta, Ohio	29	4 p. m.			500	Heavy rain	Basements and streets flooded with damage to church basement of $500.
Elbing, Kans	29	6 p. m.	1, 32	0 0	2,500	Tornado	Number of farm buildings wrecked and telephone lines down; path 3 miles long.
Osceola, Nebr., vicinity of	30	10:30 a. m.			10,000	Hail	Much corn damaged; path 3 miles long.
Elida, N. Mex	30	Noon–12:10 p. m.			1,000	Heavy hail	Loss to crops; poultry killed.
Norfolk, Va	31				500	Electrical	Property damaged.

[1] Miles instead of yards.

SOLAR RADIATION AND SUNSPOT DATA FOR JULY 1941

SOLAR RADIATION OBSERVATIONS

By HELEN CULLINANE

Measurements of solar radiant energy received at the surface of the earth are made at 9 stations maintained by the Weather Bureau and at 12 cooperating stations maintained by other institutions. The intensity of the total radiation from sun and sky on a horizontal surface is continuously recorded (from sunrise to sunset) at all these stations by self-registering instruments; pyrheliometric measurements of the intensity of direct solar radiation at normal incidence are made at frequent intervals on clear days at three Weather Bureau stations (Madison, Wis.; Lincoln, Nebr.; and Albuquerque, N. Mex.) and at the Blue Hill Observatory at Harvard University. Occasional observations of sky polarization are taken at the Weather Bureau station at Madison and at Blue Hill Observatory.

The geographic coordinates of the stations, descriptions of the instrumental equipment, station exposures, and methods of observation, together with summaries of the data obtained, up to the end of 1939, are given in the MONTHLY WEATHER REVIEW for December 1937 and April 1941.

Table 1 contains the measurements of the intensity of direct solar radiation at normal incidence, with means and their departures from normal (means based on less than 3 values are in parentheses). At Lincoln, Madison, Albuquerque, and Blue Hill the observations are obtained with a recording thermopile, checked by observations with a Smithsonian silver-disk pyrheliometer at Blue Hill. The table also gives vapor pressures at 7:30 a. m. and at 1:30 p. m. (75th meridian time).

Table 2 contains the average amounts of radiation received daily on a horizontal surface from both sun and sky during each week, their departures from normal and the accumulated departures since the beginning of the year. The values at most of the stations are obtained from the records of the Eppley pyrheliometer recording on either a microammeter or a potentiometer.

In compliance with numerous requests received, the Solar Radiation Investigations Section will from now on publish daily totals for table 2 for all stations except Fairbanks, Alaska, as well as the weekly means previously published. If the daily figures for total solar and sky radiation at Fairbanks should be desired, they may be obtained approximately 2 months after the date of the observation by writing to the Solar Radiation Investigations Supervisory Station, Blue Hill Observatory, Milton, Mass.

Radiation at normal incidence was below normal at Madison, Wis.

Total solar and sky radiation during July was below normal at Washington, New York, Cambridge, Fairbanks, La Jolla, and Newport, and excessive at all other stations, with the exception of Albuquerque, where it was approximately normal. Attention is called to the fact that radiation data for State College, Pa., appear in table 2 for the first time.

Polarization measurements during July at Madison gave a mean for 6 measurements of 50 percent, 8 percent below the normal for that month, while the maximum (61) was 5 percent below normal.

TABLE 1.—*Solar radiation intensities during July 1941*

[Gram-calories per minute per square centimeter of normal surface]

ALBUQUERQUE, N. MEX.

Date	Sun's zenith distance										
	7:30 a. m.	78.7°	75.7°	70.7°	60.0°	0.0°	60.0°	70.7°	75.7°	78.7°	1:30 p. m.
	75th mer. time	Air mass									Local mean solar time
		A. M.					P. M.				
	e.	5.0	4.0	3.0	2.0	[1] 1.0	2.0	3.0	4.0	5.0	e.
	mm.	*cal.*	*cal.*	*cal.*	*cal.*	*cal.*	*cal.*	*cal.*	*cal.*	*cal.*	*mm.*
July 2	8.18	0.86	0.94			1.42	1.25	1.08	0.97	0.91	8.48
July 3	9.83	.87	.94	1.06	1.19	1.39	1.20	1.06	.91	.83	10.59
July 4	8.81	.79	.88	.99	1.11						8.48
July 7	9.83	.84	.96	1.06	1.17	1.35					8.81
July 8	8.81	.80	.89	1.01	1.08	1.42	1.20	.98	.89		8.81
July 10	9.83	.80	.89	1.01	1.14	1.37					8.48
July 12	10.59			.94	1.13	1.35					10.59
July 13	10.97		.95	1.06	1.21	1.41					9.83
July 14	10.97	.79	.86	1.00	1.16	1.35					11.38
July 15	10.21	.81	.89	1.01	1.16	1.43	1.13				10.21
July 16	11.38	.85	.94	1.07	1.22	1.43	1.18		.88		11.38
July 17	10.59		.87	.99	1.15						10.97
July 19	12.24	.81	.88	1.01		1.38					10.97
July 20	14.10					1.42					13.13
July 21	12.67	.78	.88		1.19	1.43					14.10
July 22	10.97	.84	.94	1.07	1.22	1.40	1.13			.80	10.97
July 24	10.97						1.19				10.97

TABLE 1.—*Solar radiation intensities during July 1941*—Continued

ALBUQUERQUE, N. MEX.—Continued

Date	Sun's zenith distance										
	7:30 a. m.	78.7°	75.7°	70.7°	60.0°	0.0°	60.0°	70.7°	75.7°	78.7°	1:30 p. m.
	75th mer. time	Air mass									Local mean solar time
		A. M.					P. M.				
	e.	5.0	4.0	3.0	2.0	[1] 1.0	2.0	3.0	4.0	5.0	e.
	mm.	*cal.*	*cal.*	*cal.*	*cal.*	*cal.*	*cal.*	*cal.*	*cal.*	*cal.*	*mm.*
July 25	11.81			1.01	1.16	1.41		1.08	.95	.84	12.24
July 26	11.81					1.42					9.83
July 28	10.21	.81	.92	1.05	1.22	1.45	1.36	1.27			9.83
July 31	10.21	.83	.92	1.01	1.19				.91		10.21
Means		.82	.91	1.02	1.17	1.40	1.20	1.09	.92	.84	

MADISON, WIS.

Date	7:30 a. m.	5.0	4.0	3.0	2.0	[1] 1.0	2.0	3.0	4.0	5.0	1:30 p. m.
July 9	9.14	0.47	0.60	0.62							13.13
July 16	11.81	.73	.83								11.38
July 17	12.68	.49	.59								11.38
July 18	15.11		.74								13.13
July 19	12.24	.79	.84		1.19	1.46					9.47
July 21	11.38	.57	.59	.69	.84	1.06					10.59
July 24	17.37	.48	.58	.64	.81	.93					17.96
July 25	17.96	.35	.35	.60	.79	1.20					19.23
July 26	17.96		.38	.49	.64	.89					19.23
July 29	19.89	.47	.53	.66	.91	1.23					17.96
Means		.54	.60	.62	.86	1.13					
Departures		−.12	−.16	−.28	−.20	−.17					

[1] Extrapolated.

TABLE 2.—*Daily totals of solar radiation (direct+diffuse) received on a horizontal surface*

[Gram-calories per square centimeter]

	Washington	Madison	Lincoln	New York	Fresno	Albuquerque	Fairbanks	Newport	Ithaca	Cambridge	Friday Harbor	Riverside	New Orleans	La Jolla	State College
	cal.	*cal.*	*cal.*	*cal.*	*cal.*	*cal.*	*cal.*	*cal.*	*cal.*	*cal.*	*cal.*	*cal.*	*cal.*	*cal.*	*cal.*
July 2	567	607	260	554	662	741		609	495	619	721	655	641	433	505
July 3	380	641	594	128	718	746		597	536	610	531	684	338	662	81
July 4	90	679	715	116	722	542		135	511	202	693	667	453	659	66
July 5	396	692	615	410	710	594		506	713		597	668		585	690
July 6	190	505	596	353	692	626		491	454		448	649	648	444	162
July 7	221	534	648	226	648	695		382	297		743	658	663	499	272
July 8	482	677	403	348	698			136	442	359	773	656	668	389	602
Mean	332	619	547	305	693	657	425	408	492	448	644	662	569	524	340
Departure	−179	+74	−40	−160	−3	−7	−40	−167	−33	−32	+56	+69	+149	−45	
July 9	731	590	693	693	672	552		563	706	533	773	582	549	564	809
July 10	584	374	452	634	689	620		713	708	682	748	569	336	648	742
July 11	314	372	746	429	695	588		647	361	632	733	599	520	674	434
July 12	573	606	405	236	715	665		170	415	186	754	652	323	686	463
July 13	110	652	398	449	734	666		385	670	532	720	666	591	703	560
July 14	346	642	478	590	729	724		531	680	668	688	661	676	664	725
July 15	646	331	729	634	734	709		588	595	602	676	672	582	582	649
Mean	472	510	557	524	710	646	516	514	591	548	727	629	511	646	626
Departure	−26	−35	−28	+67	+25	+6	+36	−13	+107	+42	+132	+55	+102	+28	
July 16	465	533	582	556	730			498	604	375	684	649	433	579	534
July 17	375	410	703	142	678	609		165	544	129	447	696	399	450	575
July 18	480	324	743	403	714			252	686	449	657	624	481	541	640
July 19	478	688	708	328	716			224	655	275	557	666	423	563	638
July 20	561	664	690	647	711			668	699	665	194	660	265	567	699
July 21	532	651	609	587	699			709	661	637	384	636	354	381	774
July 22	529	351	669	519	685			609	544	557	542	627	468	510	712
Mean	488	517	672	454	705	(609)	356	446	628	441	495	638	403	513	653
Departure	+6	−12	+100	+26	+25	−13	−70	−39	+118	−36	−129	+77	−16	−68	
July 23	282	595	690	481	678			583	513	462	716	471	591	474	475
July 24	477	623	627	359	717			440	641	405	538	382	625	180	622
July 25	603	615	653	472	681			587	636	573	636	491	587	144	640
July 26	567	563	530	613	659			581	667	580	694	581	320	392	699
July 27	618	491	226	629	660			602	653	540	674	562		605	651
July 28	534	550	660	186	698			250	317	186	605	648		668	501
July 29	416	604	386	446	647			578	581	602	679	648	651	661	399
Mean	499	577	539	455	677		243	517	572	478	649	540	555	446	570
Departure	+9	+63	−9	+36	+25		−172	+26	+128	+1	+47	+11	+145	−60	

ACCUMULATED DEPARTURE ON JULY 29, 1941

	Washington	Madison	Lincoln	New York	Fresno	Albuquerque	Fairbanks	Newport	Ithaca	Cambridge	Friday Harbor	Riverside	New Orleans	La Jolla	State College
	+1,806	+2,023	−6,314	+11,193	−2,128		−3,192	−1,729		−63	+3,934	−1,520	+7,112	−3,388	

POSITIONS, AREAS, AND COUNTS OF SUN SPOTS FOR JULY 1941

[Communicated by Capt. J. F. Hellweg, U. S. Navy (Ret.), Superintendent, U. S. Naval Observatory.] All measurements and spot counts were made at the Naval Observatory from plates taken at the observatories indicated. Difference in longitude is measured from the central meridian, positive toward the west. Latitude is positive toward the north. Areas are corrected for foreshortening and expressed in millionths of Sun's hemisphere. For each day, under longitude, latitude, area of spot or group, and spot count, are included assumed longitude of center of the disk, assumed latitude of center of the disk, total area of spots and groups, and total spot count]

Date	Eastern standard time	Mount Wilson group No.	Heliographic: Difference in longitude	Heliographic: Longitude	Heliographic: Latitude	Heliographic: Distance from center of disk	Area of spot or group	Spot count	Plate quality	Observatory
1941	h m		°	°	°	°				
July 1	12 58	7218	−29	121	+11	30	436	11	G	U. S. Naval.
		7217	−23	127	+4	23	291	20		
		7220	+7	157	−3	10	24	4		
		7216	+16	166	−7	19	97	9		
		7212	+67	217	+15	68	339	12		
		7211	+83	233	+8	83	48	2		
				(150)	(+3)		1,235	58		
July 2	11 52	7218	−16	121	+11	17	291	10	G	Do.
		7217	−10	127	+4	10	242	16		
		7222	+16	153	+15	20	24	5		
		7216	+27	164	−7	30	24	4		
		7216	+33	170	−7	34	48	11		
		7221	+60	197	+8	60	6	1		
		7212	+80	217	+15	80	242	8		
				(137)	(+3)		877	55		
July 3	12 31	7223	−65	59	−7	66	12	2	VG	Do.
		7218	−2	122	+11	8	291	11		
		7217	+3	127	+4	2	242	15		
		7222	+29	153	+15	31	12	1		
		7221	+73	197	+9	73	97	11		
				(124)	(+3)		654	40		
July 4	8 18	7223	−52	61	−6	54	36	13	VG	Mt. Wilson.
		7218	+10	123	+12	13	291	18		
		7217	+15	128	+4	15	194	11		
		7221	+86	199	+9	86	48	2		
				(113)	(+3)		569	44		
July 5	13 20	7224	−71	26	+2	71	97	1	F	U. S. Naval.
		7223	−38	59	−6	39	97	9		
		7218	+25	122	+12	26	291	13		
		7217	+31	128	+3	31	145	1		
				(97)	(+3)		630	24		
July 6	8 26	7224	−60	26	+4	60	97	1	VG	Mt. Wilson.
		7223	−24	62	−5	26	48	8		
		7225	−12	74	+11	14	24	2		
		7218	+37	123	+12	38	339	26		
		7217	+42	128	+3	42	170	1		
				(86)	(+3)		678	38		
July 7	15 24	7224	−44	25	+3	44	73	1	G	U. S. Naval.
		7223	−11	58	−8	15	48	3		
		7223	−6	63	−4	10	24	2		
		7218	+52	121	+12	53	339	14		
		7217	+59	128	+3	59	194	1		
				(69)	(+4)		678	21		
July 8	11 17	7224	−32	26	+3	32	73	1	F	Do.
		7223	0	58	−7	11	12	2		
		7223	+5	63	−4	10	12	3		
		7225	+15	73	+12	17	12	1		
		7218	+64	122	+12	64	630	12		
		7217	+71	129	+3	71	194	1		
				(58)	(+4)		933	20		
July 9	10 56	7226	−76	329	−16	77	291	5	F	Do.
		7227	−21	24	+12	22	12	1		
		7224	−19	26	+3	19	48	1		
		7223	+15	60	−7	18	24	4		
		7225	+30	75	+13	33	24	1		
		7218	+78	123	+12	78	776	14		
		7217	+85	130	−8	85	194	1		
				(45)	(+4)		1,369	27		
July 10	11 1	7226	−62	330	−16	64	242	3	F	Do.
		7228	−19	13	+6	20	97	5		
		7227	−9	23	+12	12	24	7		
		7224	−6	26	+3	6	48	2		
		7225	+43	75	+13	44	12	1		
				(32)	(+4)		423	18		

*=Not numbered.
VG=Very good; G=Good; F=Fair; P=Poor.

POSITIONS, AREAS, AND COUNTS OF SUN SPOTS FOR JULY 1941—Continued

Date	Eastern standard time	Mount Wilson group No.	Heliographic: Difference in longitude	Heliographic: Longitude	Heliographic: Latitude	Heliographic: Distance from center of disk	Area of spot or group	Spot count	Plate quality	Observatory
1941	h m		°	°	°	°				
July 11	11 44	7226	−48	330	−16	52	145	10	VG	U. S. Naval.
		7228	−6	12	+5	6	24	7		
		7224	+8	26	+3	8	73	9		
				(18)	(+4)		242	26		
July 12	10 42	7226	−36	330	−16	40	145	12	G	Do.
		7228	+8	14	+6	8	73	9		
		7224	+20	26	+3	20	36	4		
				(6)	(+4)		254	25		
July 13	8 51	7229	−24	329	−8	34	12	3	VG	Mt. Wilson.
		7226	−21	332	−15	27	48	7		
		7224	+33	26	+3	33	24	2		
				(353)	(+4)		84	12		
July 14	8 55	7229	−12	328	−10	20	18	8	VG	Do.
		7226	−7	333	−15	21	48	8		
		(*)	−2	338	−9	13	12	4		
		7230	+2	342	−12	17	12	2		
				(340)	(+4)		90	22		
July 15	12 1	7226	−5	320	−16	21	6	3	VG	U. S. Naval.
		7226	+2	327	−16	20	36	3		
				(325)	(+4)		42	6		
July 16	11 1	7232	−84	229	+15	84	145	1	F	Do.
		7231	−75	238	+7	75	242	1		
		7226	+16	329	−16	25	12	1		
				(313)	(+4)		399	3		
July 17	12 4	7235	−72	227	+9	72	12	1	VG	Do.
		7232	−68	231	+13	68	145	1		
		7231	−61	238	+7	61	97	1		
		7234	+25	324	−15	32	170	15		
		7233	+31	330	+15	33	12	3		
				(299)	(+5)		436	21		
July 18	13 57	7235	−61	224	+9	61	12	2	G	Do.
		7232	−54	231	+13	55	145	1		
		7231	−47	238	+7	47	97	1		
		7234	+40	325	−15	45	412	15		
		7233	+45	330	+15	46	121	7		
				(285)	(+5)		787	26		
July 19	12 36	7235	−50	222	+9	50	12	2	G	Do.
		(*)	−42	230	−6	44	12	4		
		7232	−41	231	+15	42	97	1		
		7231	−35	237	+7	35	73	1		
		7234	+53	325	−15	56	436	10		
		7233	+57	329	+14	58	97	9		
				(272)	(+5)		727	27		
July 20	11 29	7236	−72	187	−9	73	194	1	F	Do.
		7235	−38	221	+10	38	121	12		
		7232	−29	230	+16	31	97	1		
		7231	−22	237	+7	22	73	1		
		7234	+66	325	−15	67	388	5		
		7233	+71	330	+14	71	97	4		
				(259)	(+5)		970	24		
July 21	12 6	7238	−77	169	−6	78	97	8	VG	Do.
		7237	−71	175	+11	71	97	7		
		7236	−60	186	−9	62	242	8		
		7235	−24	222	+10	25	97	12		
		7232	−15	231	+16	19	97	1		
		7231	−8	238	+7	9	48	1		
		7233	+82	328	+14	82	242	4		
				(246)	(+5)		920	41		
July 22	11 38	7238	−63	170	−7	63	388	19	VG	Do.
		7237	−59	174	+11	59	194	12		
		7236	−52	181	−11	54	12	2		
		7236	−47	186	−9	50	97	1		
		7239	−31	202	+18	34	12	4		
		7235	−9	224	+9	10	48	5		
		7232	−2	231	+16	11	97	1		
		7231	+6	239	+7	6	48	1		
				(233)	(+5)		896	45		
July 23	12 11	7238	−49	170	−7	50	630	23	F	Do.
		7237	−47	172	+11	47	170	6		
		7236	−33	186	−9	36	97	1		
		7235	+7	226	+9	8	24	1		
		7232	+11	230	+16	15	97	1		
		7231	+19	238	+7	20	48	1		
				(219)	(+5)		1,066	33		

POSITIONS, AREAS, AND COUNTS OF SUN SPOTS FOR JULY 1941—Continued

Date	Eastern standard time	Mount Wilson group No.	Heliographic: Difference in longitude	Heliographic: Longitude	Heliographic: Latitude	Heliographic: Distance from center of disk	Area of spot or group	Spot count	Plate quality	Observatory
1941	h m		°	°	°	°				
July 24	11 3	7240	−86	121	+11	86	582	2	VG	U. S. Naval.
		7241	−77	130	+2	77	145	1		
		7238	−35	172	−7	37	727	36		
		7237	−33	174	+11	33	97	8		
		7236	−19	188	−9	24	121	8		
		7235	+20	227	+10	21	12	1		
		7232	+25	232	+15	27	73	1		
		7231	+31	238	+7	31	36	1		
				(207)	(+5)		1,793	58		
July 25	10 39	7240	−71	123	+11	71	582	3	VG	Do.
		7241	−64	130	+3	64	121	1		
		7238	−20	174	−6	23	727	36		
		7237	−20	174	+11	21	73	7		
		7236	−7	187	−9	15	121	8		
		7232	+38	232	+15	39	48	1		
		7231	+45	239	+7	45	12	1		
				(194)	(+5)		1,684	57		
July 26	10 46	7240	−59	121	+12	59	679	12	VG	Do.
		7241	−51	129	+3	51	97	3		
		7238	−17	163	−9	22	73	12		
		7237	−9	171	+13	12	73	8		
		7237	−7	173	+11	9	24	9		
		7238	−7	173	−5	12	970	40		
		7236	+8	188	−9	16	121	8		
		7232	+50	230	+16	52	48	4		
				(180)	(+5)		2,085	96		
July 27	9 4	7240	−48	120	+12	49	679	21	G	Mt. Wilson.
		7241	−37	131	+3	37	97	1		
		7238	−3	165	−7	11	97	15		
		7238	+7	175	−5	12	970	70		
		7237	+7	175	+13	11	145	23		
		7236	+20	188	−8	24	121	6		
		7232	+63	231	+16	64	12	4		
				(168)	(+5)		2,121	140		
July 28	11 35	7243	−80	74	−7	80	194	6	VG	U. S. Naval.
		7242	−59	95	+9	59	24	2		
		7240	−33	121	+11	33	679	16		
		7241	−22	132	+3	23	73	1		
		7241	−17	137	+6	17	24	7		
		7238	+20	174	−6	23	1,309	76		
		7237	+20	174	+13	22	194	20		
		(*)	+30	184	+25	35	24	4		
		7236	+36	190	−9	40	48	5		
				(154)	(+6)		2,569	137		
July 29	14 18	7243	−65	74	−6	67	436	20	G	Do.
		7242	−48	91	+9	48	12	3		
		7240	−18	121	+11	19	679	21		
		7241	−8	131	+3	9	73	4		
		7241	−4	135	+7	4	24	9		
		7238	+35	174	−6	37	1,115	50		
		7237	+35	174	+14	35	242	17		
				(139)	(+6)		2,581	124		
July 30	11 42	7244	−86	41	+8	86	194	1	G	U. S. Naval.
		7243	−53	74	−6	55	436	24		
		7240	−6	121	+12	8	679	22		
		7241	+5	132	+3	5	97	5		
		7237	+45	172	+14	45	339	20		
		7238	+48	175	−5	50	1,115	45		
				(127)	(+6)		2,860	117		
July 31	12 19	7244	−74	39	+9	74	582	6	G	Do.
		7243	−43	70	−7	46	145	16		
		7243	−35	78	−7	38	194	8		
		7240	+8	121	+12	10	533	12		
		7241	+19	132	+3	19	97	1		
		7245	+23	136	+18	26	12	3		
		7237	+58	171	+14	58	242	9		
		7238	+62	175	−4	63	1,261	30		
				(113)	(+6)		3,066	85		

Mean daily area for 31 days=1,088.

*=Not numbered.
VG=Very good; G=good; F=Fair; P=poor.

PROVISIONAL RELATIVE SUNSPOT NUMBERS FOR JUNE 1941

[Based on observations at Zurich and Locarno. Data furnished through the courtesy of Prof. W. Brunner, Eidgenössische Sternwarte, Zurich, Switzerland]

June 1941	Relative numbers	June 1941	Relative numbers	June 1941	Relative numbers
1	37	11	*83	21	40
2	21	12	*a*74	22	*Ec*36
3	*d*47	13	62	23	*d*47
4	*a*53	14	*a*56	24	61
5	*a*61	15	45	25	*a*59
6	70	16	22	26	*Eac*71
7	61	17	*Mc*29	27	*dd*74
8	*Ec*97	18	*Ec*28	28	82
9	*bd*118	19	28	29	*a*94
10	95	20	*Emc*45	30	98

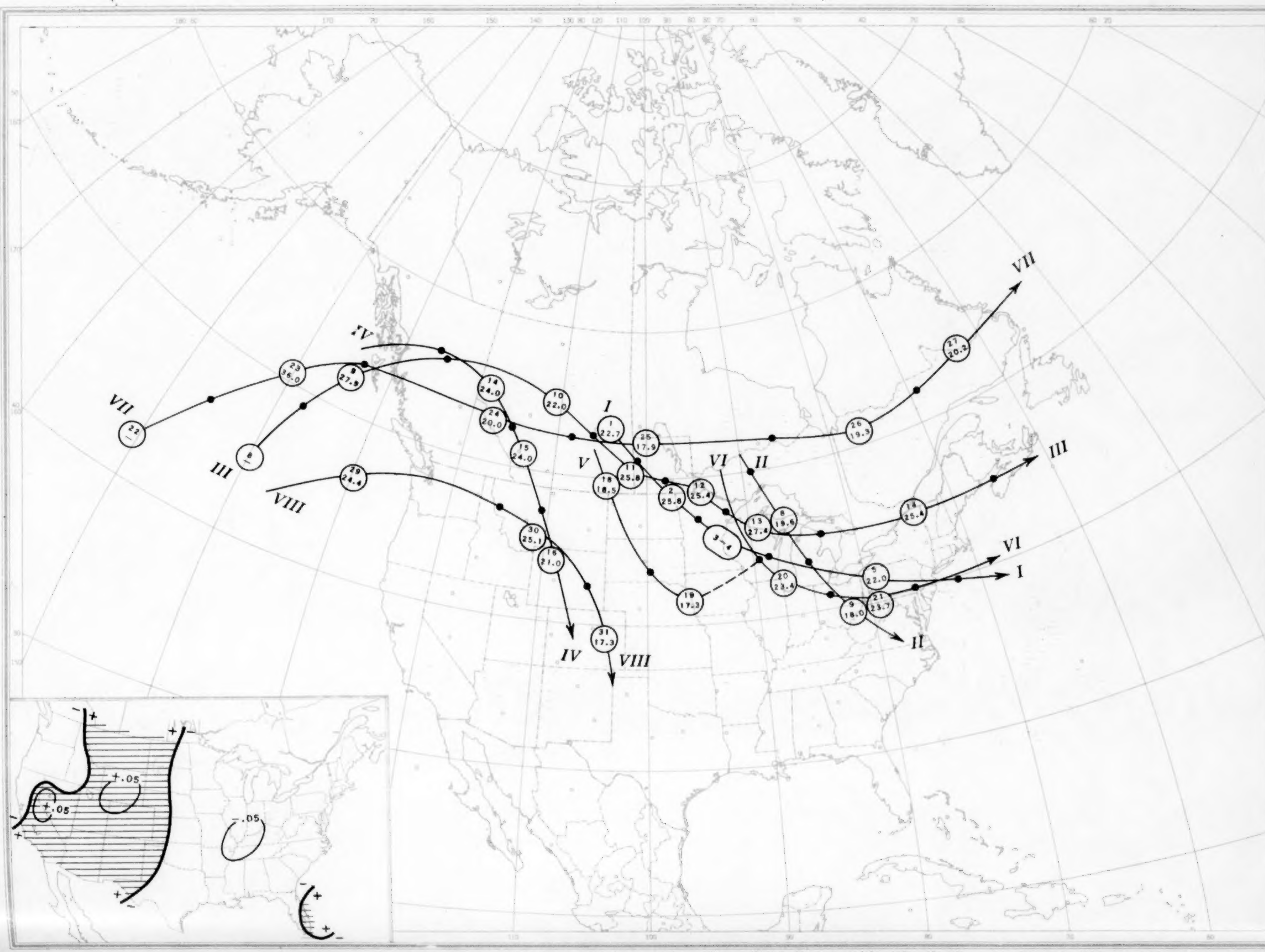
Mean, 30 days 59.8

*=Observed at Locarno.
a=Passage of an average-sized group through the central meridian.
b=Passage of a large group through the central meridian.
c=New formation of a group developing into a middle-sized or large center of activity: *E*, on the eastern part of the sun's disk; *W*, on the western part; *M*, in the central-circle zone.
d=Entrance of a large or average-sized center of activity on the east limb.

Chart I. Departure (°F.) of the Mean Temperature from the Normal, and Wind Roses for Selected Stations, July 1941

Chart I. Departure (°F.) of the Mean Temperature from the Normal, and Wind Roses for Selected Stations, July 1941

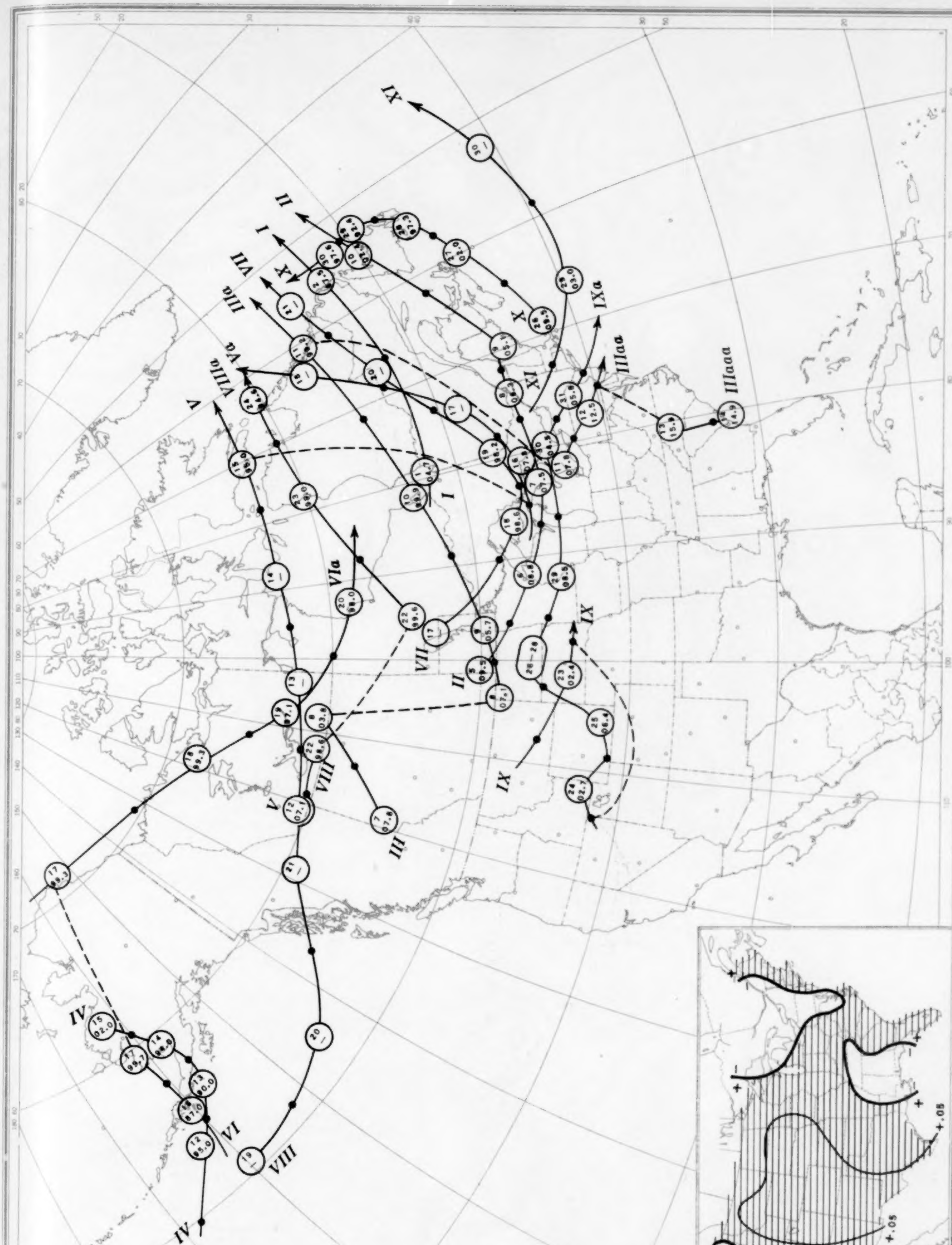
Chart II. Tracks of Centers of Anticyclones, July 1941. (Inset) Departure of Monthly Mean Pressure from Normal



Circle indicates position of anticyclone at 7:30 a. m. (75th meridian time), with barometric reading. Dot indicates position of anticyclone at 7:30 p. m. (75th meridian time).

Chart III. Tracks of Centers of Cyclones, July 1941. (Inset) Change in Mean Pressure from Preceding Month

Chart III. Tracks of Centers of Cyclones, July 1941. (Inset) Change in Mean Pressure from Preceding Month



Circle indicates position of cyclone at 7:30 a. m. (75th meridian time), with barometric reading. Dot indicates position of cyclone at 7:30 p. m. (75th meridian time).

Chart IV. Percentage of Clear Sky Between Sunrise and Sunset, July 1941

Chart V. Total Precipitation, Inches, July 1941. (Inset) Departure of Precipitation from Normal

Chart V. Total Precipitation, Inches, July 1941. (Inset) Departure of Precipitation from Normal

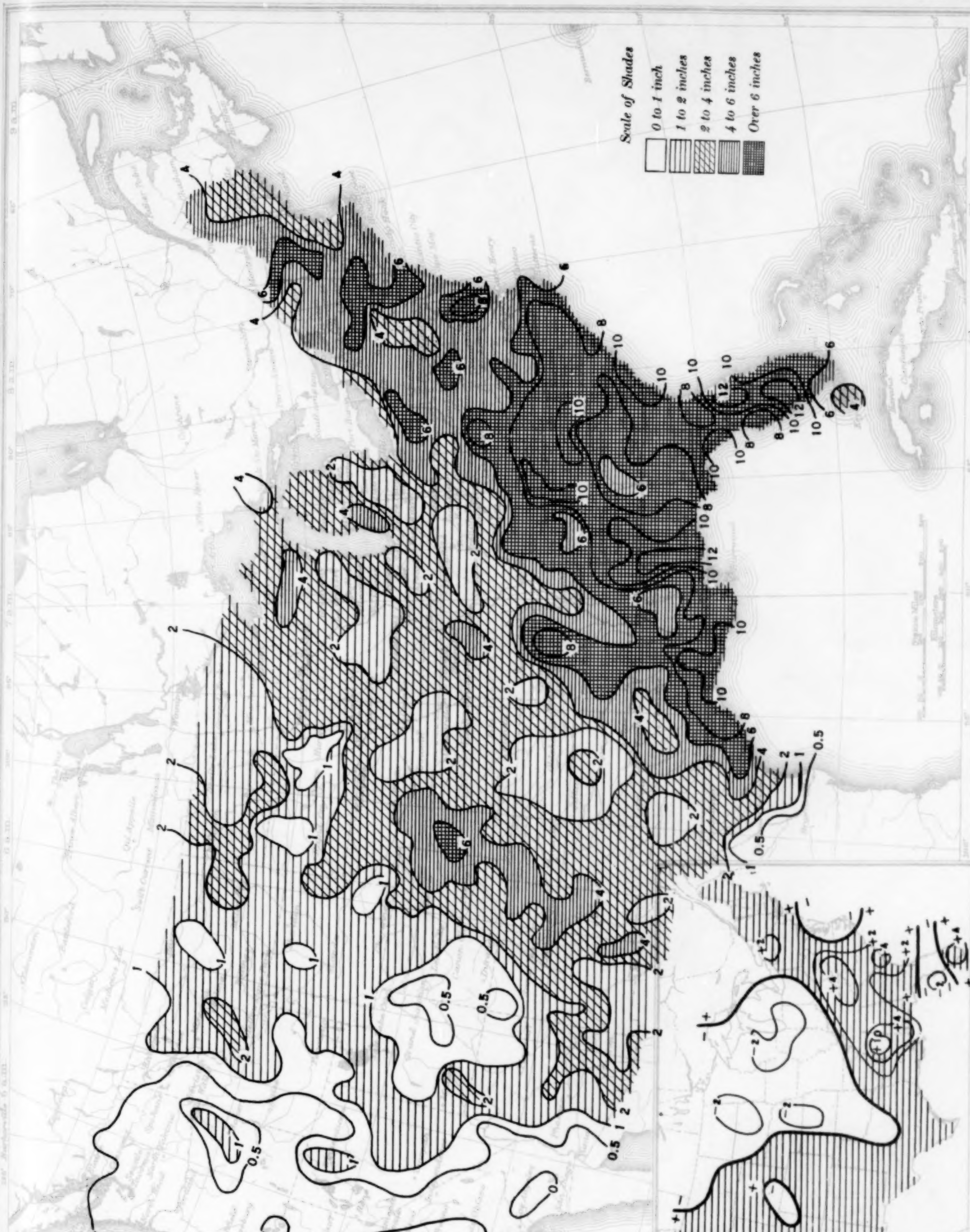


Chart VI. Isobars at Sea Level and Isotherms at Surface; Prevailing Winds, July 1941

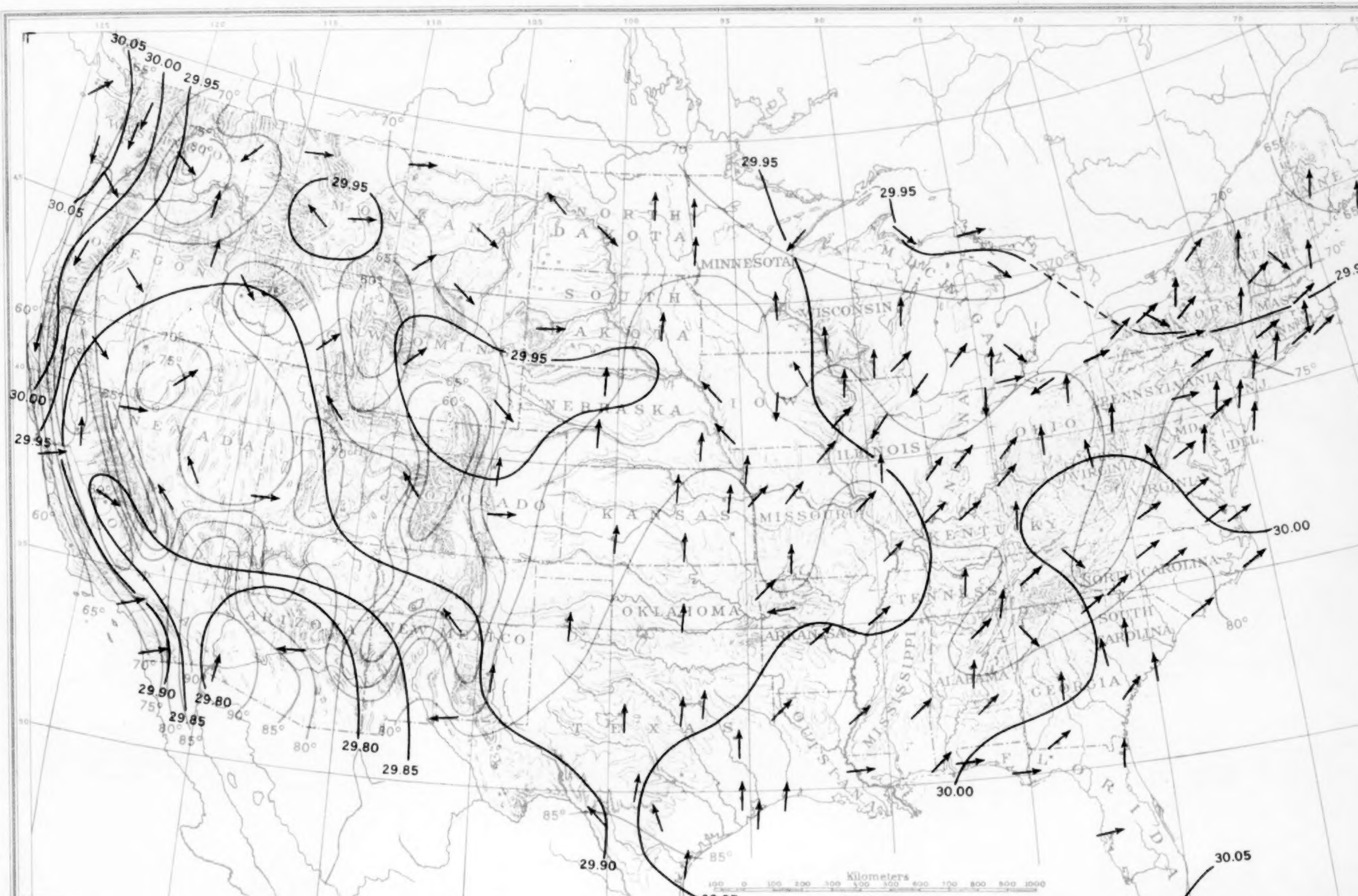


Chart VIII. Isobars (mb) for 1,524 Meters (5,000 ft.) and Isotherms (°C.) and Resultant Winds for 1,500 Meters (m. s. l.) July 1941
Isobars and isotherms based on radiosonde observations at 12:30 a. m. (E. S. T.) and winds based on pilot-balloon observations at 5:00 a. m. (E. S. T.).

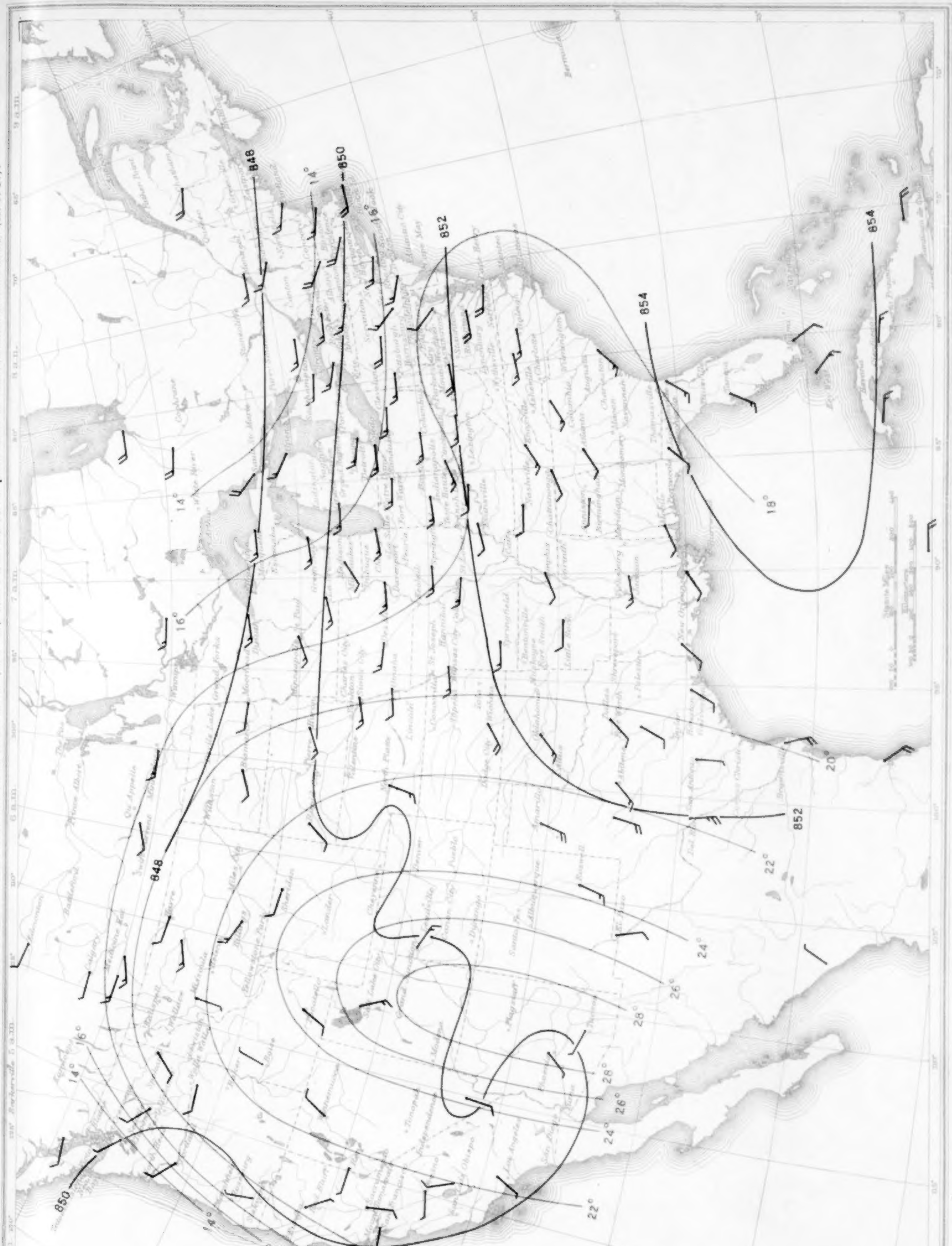


Chart VIII. Isobars (mb) for 1,524 Meters (5,000 ft.) and Isotherms (°C.) and Resultant Winds for 1,500 Meters (m. s. l.) July 1941
Isobars and isotherms based on radiosonde observations at 12:30 a. m. (E. S. T.) and winds based on pilot-balloon observations at 5:00 a. m. (E. S. T.).

Chart IX. Isobars (mb) Isotherms (°C.) 1:00 a. m. (E. S. T) and Resultant Winds 5:00 a. m. (E S. T.) for 3,000 Meters (m. s. l.) July 1941

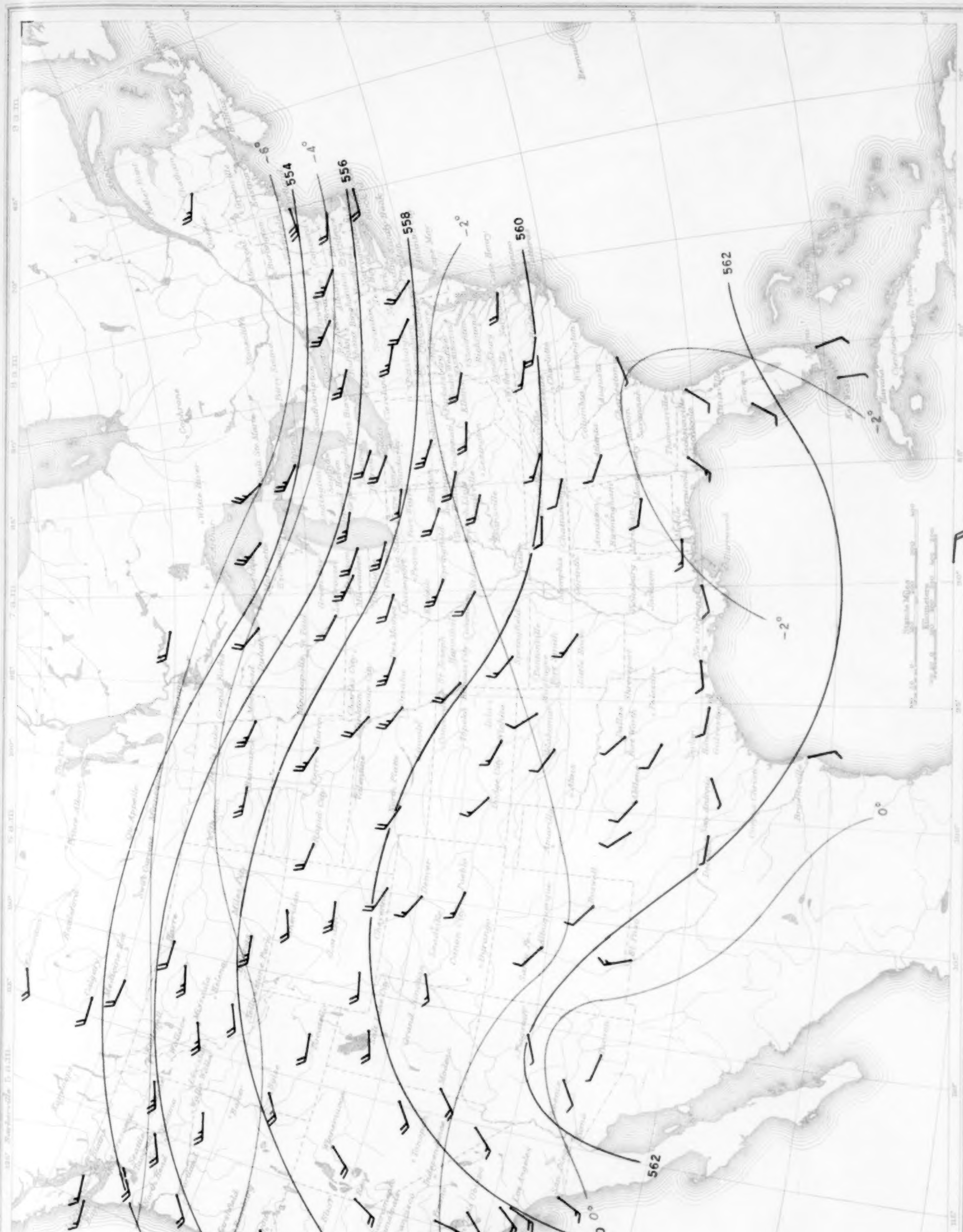


Chart X. Isobars (mb) Isotherms (°C.) 1:00 a. m. (E. S. T.) and Resultant Winds 5:00 p. m. (E. S. T.) for 5,000 Meters (m. s. l.) July 1941

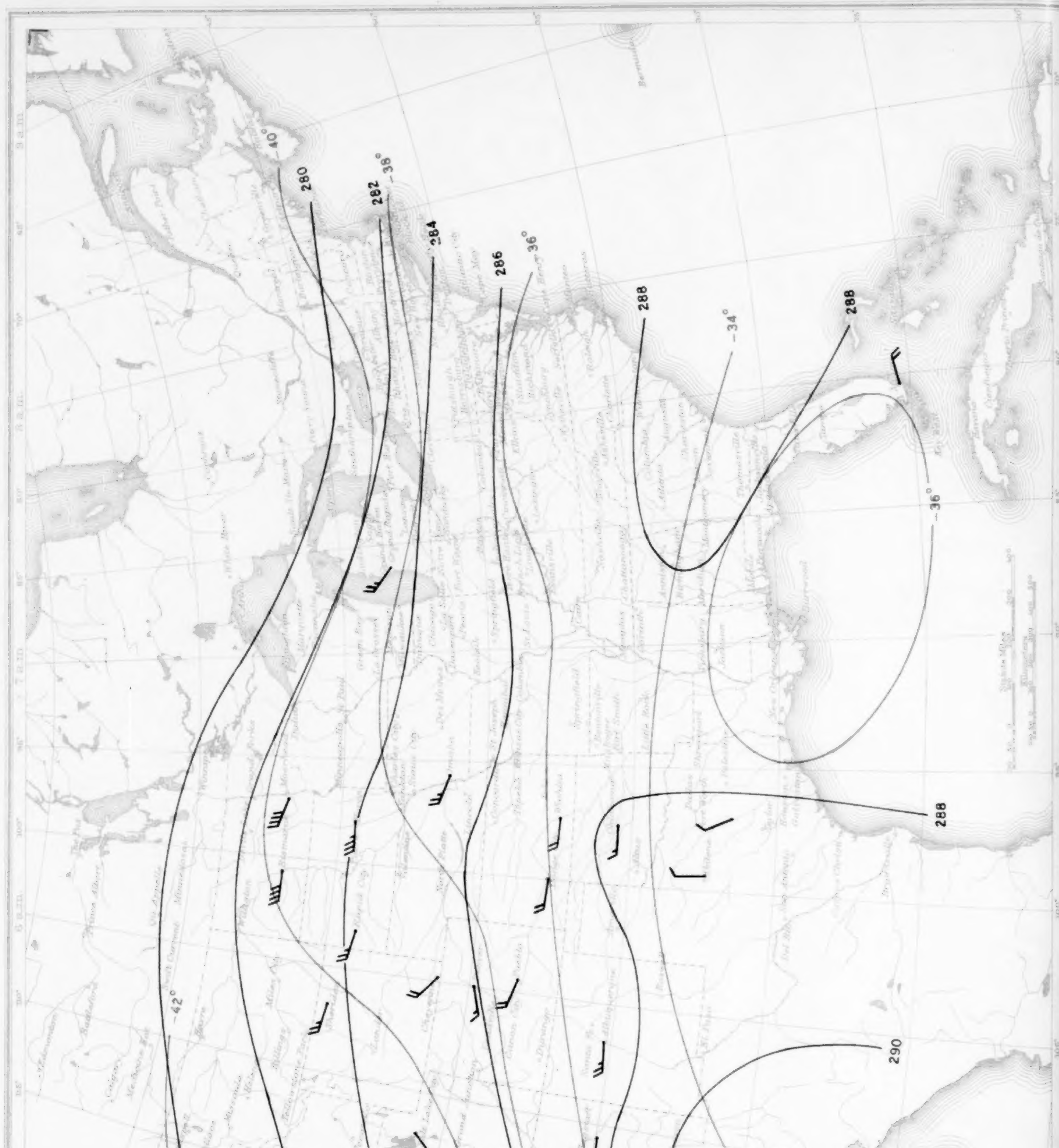


Chart XI. Isobars (mb) Isotherms (°C.) 1:00 a.m. (E. S. T.) and Resultant Winds 5:00 p.m. (E. S. T.) for 10,000 Meters (m. s. l.) July 1941